

Subterranea

August 2014 Issue 36

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In This Issue...

Crystal Palace High-Level Station Subway

London's Lost Rivers

Lapal Canal Restoration Project

Sub Brit's Prague Study Weekend

Subterranea Britannica



www.subbrit.org.uk

Subterranea Britannica is a society devoted to the study of man-made and man-used underground structures and the archaeology of the Cold War. The society is open to all and its membership includes all walks of life. Members are invited to contribute to this magazine even if this just means sending very welcome snippets from newspapers and magazines.

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Contents

From the Chairman _____	1	Sub Brit's Prague Study Weekend, May 2014 _____	32
Dates for Your Diary _____	2	And There Was Light _____	43
News			
Archaeology _____	3	A Return to Alderney _____	44
Conservation and Heritage _____	3	Ancient Mysteries Under Naples _____	48
Health & Safety _____	4	Lundy Island, Devon _____	50
Military and Defence _____	4	Basement Shelters _____	51
Mining and Quarrying _____	6	The Lupal Canal Restoration Project _____	54
Miscellaneous _____	9	Royal Observer Corps Centre, Bury St. Edmunds _____	60
Tunnels and Tunnelling _____	10	Southampton Docks Fortified Telephone Exchange & Docks Control Bunker _____	63
Features			
Crystal Palace High-Level Station Subway _____	17	The Atlantic Avenue Subway, Brooklyn, New York _____	67
Visit to Stationary winding-engine vaults at Camden _____	24	Canada's Other Secret Nuclear Bunker _____	68
London's Lost Rivers _____	25	Sir Edward Watkin, Railway Entrepreneur Extraordinaire _____	69
		Some Historic Mine Sites in Co. Kerry _____	71
		Sub Brit Visit to Godstone Hill Mine _____	72

Front cover photo: One of the two sheave rooms in the stationary winding engine vaults in Camden. The 20ft return wheel was located with the rope passing through the roof. The rope to the tightening sheave passed through the two low level openings seen on each side of the arch. The vaults have been pumped out for inspection, the water level normally being at the distinct line halfway up the walls. Photo Nick Catford

Back page upper: The Sub Brit party eagerly awaits boarding of the narrow-gauge railway carriage for transportation along the *Kolektory* in Prague. Photo Clive Penfold

Back page lower: The now roofless first-class concourse on the Bromley side of the Crystal Palace subway in October 1985. The steps up to the Crystal Palace site are behind the photographer and the High-Level station is through the subway. Prior to this date the entrances to the subway had been bricked up while the subway was being used to store statues from Crystal Palace Park. Photo Nick Catford

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Newsletters of Subterranea Britannica are published by the committee of Subterranea Britannica. Original articles, book reviews, press cuttings, extracts from books and journals, letters to the Editor etc are welcome.

However the Editor reserves the right not to publish material without giving a reason.

The committee of Subterranea Britannica and the Editor do not necessarily agree with any views expressed and cannot always check the accuracy of any material sent in.

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Chairman's Welcome

Martin Dixon

On Saturday 7 June around eighty Sub Brit members and partners met to celebrate the 40th birthday of Subterranea Britannica. Starting with a river and rail tour of Brunel's London, we then descended into the original construction shaft of his famous Thames Tunnel, dating from 1825, and had a brilliant three-course meal emulating Brunel's own subterranean banquet in November 1827, although sadly without the band of the Coldstream Guards whose music Brunel's guests enjoyed.

It was great to see members old and new including our founder Sylvia Beamon socialising and enjoying such a great party. I'd like to record the thanks of myself and the committee to all who made it possible: Robert Hulse of the Brunel Museum; our caterer Julie Friend; Father Mark from the local church for the tables and chairs; and all those members who helped with the set-up and tidying. Not forgetting the Box Steam Brewery who provided an ample supply of *Tunnel Vision* beer at cost to quench our thirst.

Another attendee and speaker at the celebration was historian and broadcaster Dan Cruickshank who, as announced on the night, has generously agreed to become Subterranea Britannica's President.

I know many members will have seen Dan's TV appearances; I particularly remember his programme *Around the World in 80 Treasures*. This featured amongst its treasures a number of top underground sites including the Wieliczka Salt Mine in Poland, the Moscow Metro, Derinkuyu underground city in Turkey, the Mesa Verde caves in Colorado and the rock-cut tombs of Petra. Together these represent many underground site types about which we are all so passionate – extraction, transport, shelter, dwelling and religion. I know you will join me in welcoming Dan and we look forward to his company at some of our future events.

Sub Brit has been in the news itself recently. Nick Catford was interviewed in June for the Mike Forrest local radio show, my own article on the deep-level shelters appeared in July's *Britain at War* magazine, Gavin Saxby and the rest of the team's work at Craigiebarns ROC HQ was covered on Scottish Television and Mark Russell's recent visit to the Stokes Bay Lines was featured in BBC Radio 4's *Making History* in August. All publicity is good publicity and as well as adding public awareness it also provides a good source of future members. If you have any ideas about media coverage then please get in touch with Andrew Smith on pr@subbrit.org.uk.

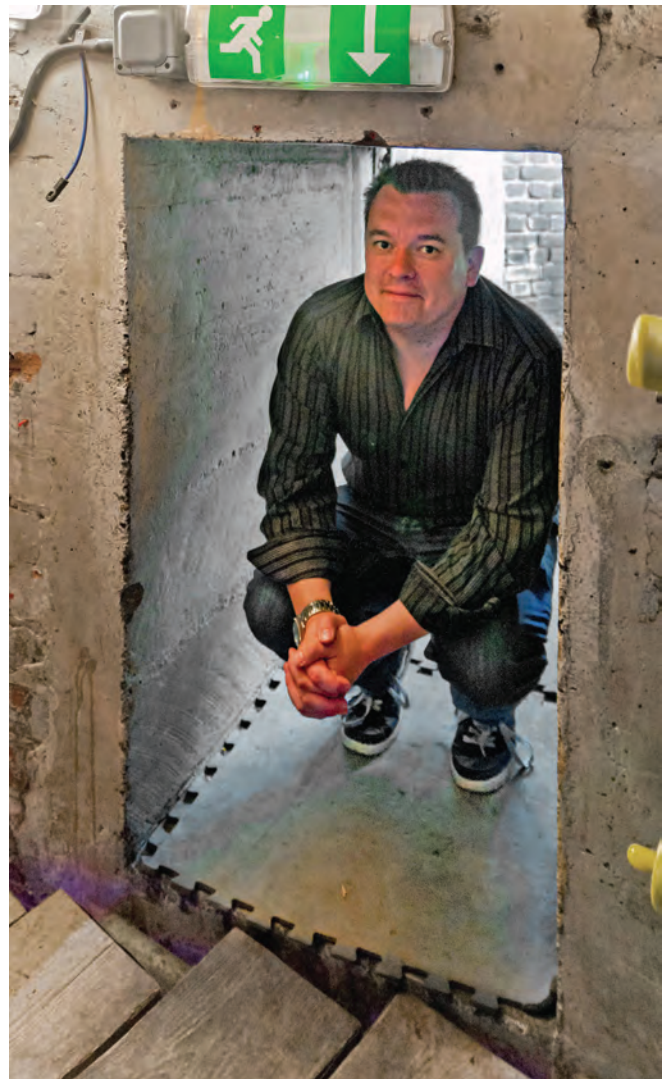
For many years now Sub Brit has had an email discussion list for members. Over the years there has been increasing demand to move to a 'forum'-type exchange and thanks to hard work by Richard Seabrook, this should be implemented in September. The ability to upload members' photos will, I expect, be particularly

welcomed. The forum will also be searchable so it should allow all of us to chase postings about sites or topics of particular interest. Change is rarely without pain but I think the development (which will use members' existing 'mySubBrit' log-ons) is very exciting.

As you read on, you'll notice that our magazine has, for the first time, been produced with colour illustrations throughout. Improvements in printing technology have allowed us to do this without increasing costs versus last year. I hope this will make the articles within even more enjoyable and we plan to make it a permanent feature. Thanks as ever to our editor Nick Catford for spotting this opportunity.

A special supplement is included in this edition of *Subterranea*, detailing the history of our society. Some things have changed over forty years but others haven't. Our passion for the underground, the hard work of those who support our society and the fun we have together were all there at an early date. Long may it continue!

chairman@subbrit.org.uk



Mark Russell in the entrance passage to our 40th birthday venue shows the space through which all the tables, chairs, food, drink (and of course guests!) had to be squeezed. Photo Ed Combes



SUBTERRANEA BRITANNICA DIARY

Summary of Forthcoming Events

Sub Brit specific events

- 20 September Paddock open day
27 September Cultybraggan RGHQ open day
11-12 October SB Autumn meeting, Newcastle
16-20 October Project Riese visit - Poland
19 October Bury St Edmunds ROC Guildhall Ops Room Open Day for SB and ROCA members
25 October SB Committee meeting
1 November Copy deadline for *Subterranea* 37
mid-December *Subterranea* 37 published

2015

- 1 March Copy deadline for *Subterranea* 38
April *Subterranea* 38 published
18 April SB Spring Meeting, Imperial College, London
May (TBA) Paddock open day

Other underground-related events

- 1-30 September Open Doors, Wales <http://cadw.wales.gov.uk/events>
6-28 September Doors Open Days, Scotland
9 September London Underground Railway Society talk "Mind the Gap" – The London Underground through the camera of Jason Cross. <http://lurs.org.uk/meetings.htm>
11-14 September Heritage Open Days, England
13 September Reigate Caves public open days
13 September Cuckfield ROC Post open day
13-14 September European Heritage Open Days, Northern Ireland
14, 28 September, 12 October Canal Boat trip from London Canal Museum through London's longest tunnel
20-21 September Open House London
26-28 September Hidden Earth – Leek, Staffordshire
11-12 October Société Française d'Etudes des Souterrains Congress, France
12 October Crossness Engines Public Steaming Day. Belvedere Road, Abbey Wood, London SE2 10.30am-4pm. £6 adults. No booking required. www.crossness.org.uk

2015

- 25 April SERIAC conference, Southampton
20-25 May NAMHO Conference – Nenthead, Cumbria
For web links to these events please visit www.subbrit.org.uk/events
or contact the Society concerned

If you know of other relevant events run by other societies, please let us know so that they can be advertised in the next edition and on the website

Sub Brit on eBay

Readers may be interested to know that we have recently registered Subterranea Britannica on eBay as an 'eBay for Charity' partner. This means that anyone can nominate Sub Brit to receive a percentage (between 10 and 100%) of the proceeds of any eBay sale. More general information is on the eBay website



Our own home page from which you can initiate a sale is at:
http://donations.ebay.co.uk/charity/charity.jsp?NP_ID=64157

There's no pressure to do so but any money received will, of course, be used for our charitable ends



NEWS

Miscellany compiled by Paul Sowan
and Nick Catford

NEWS – ARCHAEOLOGY

Archaeology by tunnelling, Silbury Hill, Wiltshire

Silbury Hill in Wiltshire, seven miles west of Marlborough, is not as the name suggests a natural landform. It is a very large heap of (mostly) chalk, rising to a height of 135 feet above the surrounding land. A truncated cone in shape, it has a circumference of 1,680 feet at the base, and 315 feet at the top; it is the largest prehistoric man-made mound in Europe. Like Stonehenge, not far away, its date, purpose and construction has been fertile ground for speculation and investigation for some centuries.

Was this a vanity project of a megalomaniac chieftain, priest (or politician)? How long did it take to build, and how many people built it? What, if anything, is hidden in the middle?

One Colonel Edward Drax investigated by having a vertical shaft sunk from the top of the hill in 1776. His only reported find was, apparently, a 'thin slip of oakwood': no treasure and no burial. In 1849 the Very Reverend John Merewether had another go, burrowing in from the base, with similarly disappointing results. Archaeologists in those days took notice only of the more obvious human artefacts such as weapons, fine pottery, and treasure!

The third intervention, filmed live on BBC television in 1968–70, was directed by one Richards Atkinson, who again tunnelled to the centre, and found nothing much, yet again! The tunnel door was closed and locked, and hidden behind soil bulldozed in front of it.

Until 2000 it was assumed that the shaft and both tunnels had been securely backfilled. However, in that year a crater appeared on the summit, which gradually increased in area to 40 square metres. The shaft, which had not been backfilled, had run in. A camera was lowered to photograph the bottom, and the bore stabilised by filling it with polystyrene blocks. Trial borings, and more remote examination by lowered cameras, indicated that Atkinson's tunnel had not in fact been backfilled. English Heritage was disturbed to find that large cavities remained, threatening the stability of the monument. Something had to be done!

In 2006 the locked door to Atkinson's tunnel was re-exposed. The key to the padlock was 'under the mat'! His tunnel was re-entered, allowing more extensive and satisfactory archaeological recording than had taken place for television entertainment in the 1960s, before backfilling. The detailed stratigraphy of the chalk, clay, soil, gravel, and turf layers from which the mound was built was recorded, and well-preserved insect and plant remains retrieved for examination. Atkinson's interpretation of the mound having been built in four distinct phases has been radically re-assessed. It was started in or about 2450 BC, and completed by more or less continuing additions



Richard Atkinson's 1968 tunnel

to the heap in from about 50 to 150 years. The sarsen stone trilithons at Stonehenge were being erected at about the same time. Bits of sarsen stone, and Preseli Hills 'bluestone' from Pembrokeshire, turned up at Silbury.

Although the Romans had a settlement nearby, they seem to have ignored or avoided the hill. The next crop of archaeological evidence is from Saxon times when a spiral pathway to the top was created, to give access to a timber fortification.

The hill is still enigmatic. Whether those who started it had a view of their intended creation four or five generations later is doubtful. Was it even completed, or did the builders simply stop?

English Heritage has published a comprehensive report on the latest work at Silbury, '*Silbury Hill: the largest prehistoric mound in Europe*' edited by Jim Leary, David Field and Gill Campbell. It costs £100!

SOURCE: SYMONDS, Matthew, 2014, The many faces of Silbury Hill: unravelling the evolution of Europe's largest prehistoric mound. *Current Archaeology* 25(5)(293)

Medieval tunnel network unearthed in County Antrim

A dwelling and a network of underground passageways has been unearthed during archaeological digs ahead of the A26 road building project in Co. Antrim, and the tunnels could be nearly one-and-a-half millennia old. The £65m roads project involves creating seven kilometres of dual carriageway between Glarryford and the Drones Road.

The network of passages which have been found – known as a *southern* – date back to the early medieval period, ranging from 600AD to 1200AD. Some of them are lined with stone, and were used by residents to hide from raiding parties, who would have scoured the area looking for potential slaves.

The early house dates to the Mesolithic period around about 7,000 years ago and is considered a particularly exciting discovery.

It is anticipated that construction of the dual carriageway will begin in the later part of this year. The improvements on the A26, which links Ballymena to Coleraine, are being carried out in a bid to reduce journey times and cut accidents.

SOURCE: *Belfast News Letter*, 23 June 2013



A 13th-century wine cellar and a 16th-century sewer recorded in Sussex

As well as a steady stream of new publications, your scribe constantly adds older material to his files. A recently received 1994 newsletter contains news of two small sites of subterranean interest.

At Seaford, on the East Sussex coast, a 13th-century vaulted undercroft has been reported below a building known as the Crypt. However, this is clearly not an ecclesiastical building, but appears to have been a merchant's house. Wine storage has been proposed as the cellar's original purpose, as vine leaves are carved on the rood bosses. Seaford was a port in the Middle Ages, so may well have seen imported wine from France.

At Ticehurst, East Sussex, what is clearly a sixteenth-century stone-lined barrel-vaulted sewer is reported, 50 metres long, 1.05 metres high, and narrow enough to crawl along (for clearing blockages). It served a garderobe turret at a property built for one Bernard Randolph at Wardsbrook, and was later the outflow route from a Victorian water closet, discharging to a nearby stream. The report includes a photograph.

SOURCES: ANON, 1994, Seaford's wine trade, and MARTIN, David, and Barbara MARTIN, 1994, Tunnels and toilets. *University College London Field Archaeology Unit News* 4 (Spring 1994)

NEWS – HEALTH AND SAFETY

Twenty die in Moscow metro derailment

A train derailment deep underground in the Moscow metro caused at least 20 deaths and 150 injuries during the morning's rush hour on 15 July.

The accident occurred just after 9am in the west of the city between Park Pobedy and Slavyansky Bulvar stations, one of the deepest points in the Moscow metro system. Initial reports suggest a fire-alarm system was automatically triggered in error, leading to the driver braking suddenly and one of the carriages coming off the tracks.

Later, however, a spokesman for Russian investigators said they were focusing on possible faults in the train cars or subsidence under the rails as possible causes. Terrorism was ruled out.

Witnesses reported that panic took hold as people were thrown around inside the carriages. The driver of the train was among the dead. 20 seconds after the derailment the lights went out and everything shook. Panic broke out. Some men took the emergency hammers and smashed their way out.

Four hours after the incident deputy mayor Petr Biryukov said there were still seven passengers trapped inside one of the carriages underground, and rescuers were attempting to cut through metal in order to reach them. Rescuers worked throughout the day to free bodies from the wreckage. Carriages appeared to have come off the rails completely and turned on their side. Health officials said at least 106 people were hospitalised, with around half of them in serious condition.



The Moscow metro is one of the most efficient in the world, with trains running frequently and rarely stopping for signals. A journey costs 40 roubles (75p) in peak times when the trains are always crammed with commuters. It is usually the easiest and safest way to get around Moscow, although the system has been targeted by Chechen terrorists before, most recently in 2010 when twin female suicide bombers killed more than 40 people in two separate attacks. Russian authorities said there was no sign this recent incident was anything other than an accident.

SOURCE: *The Guardian*, 16 July 2014

NEWS – MILITARY AND DEFENCE

Hope Cove fails to meet its reserve price

The former RGHQ and Rotor Radar station at Hope Cove was offered for sale by auction at the St Mellion International Resort in South East Cornwall on 29 July. The bunker, adjacent to the former RAF Bolt Head, is owned by two local farmers who bought it in 2000 for £140,000, nearly three times its guide price. Since then it has been used for storage and has been opened to the public on a number of occasions including special visits for Sub Brit members.



The R6 blockhouse at Hope Cove. Photo Nick Catford

The bunker near Kingsbridge in Devon was constructed in 1952, with metre-thick walls and 56 rooms spread over two floors, one above ground and one partially below ground. It was initially used as part of ROTOR air defence scheme but in 1958 the site was taken over by the Home Office and the R6 bunker was turned into a Regional Seat of Government (RSG). Later it became in turn a Sub-Regional Control (SRC), Sub-Regional Headquarters (SRHQ) and Regional Government Headquarters (RGHQ) under various Home Office schemes.



Despite a guaranteed yearly income of £10,380 from a radio mast, the bunker which had a guide price of £300,000 – £400,000 failed to reach its reserve.

SOURCE: Nick Catford

Yeovil ROC Group Control for sale for £825,995

Planning applications to turn former Royal Observer Corps 9 Group Headquarters at Southwoods, on the outskirts of Yeovil, were first submitted to South Somerset District Council in August 2009. Five years later the conversion is complete and the bunker has now been offered for sale for £825,995.

Observatory House, as it is now called, has been exceptionally well converted into a stunning, substantial and spacious property. No expense has been spared to provide over 8000 sq ft of living space over four floors.



Set in approximately half an acre and comprising five bedrooms (all en-suite), three reception rooms, large gym, utility, workshop, office etc, the building has a heat-recovery ventilation system, sedum living roof and rainwater storage.

SOURCE: Nick Catford and Bridgman & Speak Estate Agents website

Technology company buys Cultybraggan bunker

A bunker built to house Scottish Office staff in the event of a nuclear attack has been bought by a technology firm. The bunker at Cultybraggan Camp, near Comrie in Scotland has been sold to online service company Bogons Ltd for £150,000.

Built at the end of the Cold War but never used, the bunker was bought along with the wider camp by the Comrie Development Trust in 2007. The money raised in the sale will go towards paying off loans taken out to purchase the camp.

The bunker was one of the last of its kind built in Britain, having been completed in 1990 at a cost of £30m. It would have served as Regional Government Headquarters in the event of a nuclear attack, and was equipped with a radio mast, BBC radio studio, telephone exchange, decontamination showers and dormitories.

After being closed down almost immediately following the end of the Cold War, the bunker was marketed as a good location for data storage, as it is shielded from solar flares which can affect computer equipment. A previous



Photo Nick Catford

bid to buy the site from a technology company, GCI Coms Group, fell through in 2012.

The bunker has now been sold to Bogons Ltd, an internet service firm which has over 20 years of experience working with people and businesses, dating back to 1989. The company offers services including server hosting, domain name registration and consultancy services for web firms. New owner Brandon Butterworth (a Sub Brit member) said he was “pleased” to have bought the bunker. He said: “I’ve had an initial look at what needs to be done to make it fit for business and now we will commence the work to bring it online. As well as an ideal location for long-term data and media storage projects we’ve been working on for a while, we’re also hoping that we can work with local businesses and communities to provide them with tailored internet hosting and connectivity service to meet their needs.”

The firm is also planning to offer people the opportunity to tour the bunker before work to fit it out as a data storage centre gets under way. A spokesman for the Comrie Development Trust said they were keen to progress plans for the camp and were looking forward to having Bogons Ltd for neighbours.

SOURCE: *BBC News Tayside and Central Scotland*, 21 May 2014

Campaign to preserve a Southend factory air-raid shelter

Historians have called for Second World War air-raid shelters in Essex to be preserved after it emerged they had been blocked off by rubble. A system of underground bomb shelters lies up to 25ft beneath the former Ekco factory site, in Priory Crescent, Southend.

The area has been earmarked for up to 250 homes, a new Fair Havens adult hospice and an office block. But no legal protection exists for the 75-year-old tunnels, built to shelter the electronics firm’s 3,000 staff from German bombers, when the site is redeveloped.

While artefacts found in the shelters have been put into storage, calls have been made to preserve the entire complex and even turn it into a tourist attraction.

All artefacts except the doors, which were considered to be too heavy, were removed and put into storage and will be displayed in the new £40million Museum of the Thames Estuary, planned for Southend Cliff Gardens.

Workmen then blocked off the shelters with rubble





Inside one of the shelters in 2008 before the entrance was filled with rubble

when the building were demolished in 2008. Southend councillors have called for an emergency meeting on the issue before the site is redeveloped.

Activist group Skipp has called on English Heritage to list the air-raid tunnels. Skipp are hopeful that the developers can be persuaded to make a few simple alterations to the plans that would allow the development of the housing to proceed and at the same time preserve these unique shelters for future generations.

SOURCE: *Southend Echo*, 3 April & 19 July 2014

Battle of Britain ops room closed after flash flood

Heavy rain in northwest London in the early morning on Monday 28 July stranded cars in Ruislip and Harrow and temporarily closed roads in Uxbridge.

The Battle of Britain underground operations room at the former RAF Uxbridge was forced to cancel visits after the bunker was flooded. Forty-eight hours after the deluge which brought widespread floods and transport chaos to parts of the borough, contractors were still removing the last of the rainwater which poured down the main staircase of the bunker. Although the deluge was largely stopped by smoke-resistant doors, prompting volunteers on Monday afternoon to tentatively state that catastrophe had been averted, the water managed to seep into the 60ft-deep Battle of Britain command centre.

Contractors working tirelessly since Monday had by the morning of Wednesday 30 July reduced the depth to about an inch throughout. Once the standing water has been removed the bunker will need to be dried out with the help of dehumidifiers; this will take several weeks.

Although much of the water was held back by the doors all the carpets will have to be replaced and a few small artefacts have been damaged. Crucially, although water did eventually reach the famous plotting room, it sat at

floor level at the entrances and did not rise sufficiently to enter a room that has a higher floor than the bunker's ground level. All of the historic parts of the building are slightly raised and luckily they have not been damaged. Measures are being looked at to stop such a disaster happening again but they need to be assessed for cost-effectiveness.



The bunker housed the Fighter Command No.11 group operations room throughout World War II, where the air defence of London and South East England was planned.

SOURCE: *Get West London*, 30 July 2014

NEWS – MINING AND QUARRYING

More chalk mine subsidences in and around Reading and south Oxfordshire

The very wet winter of 2013 / 2014 brought to light numbers of abandoned chalk mine sites in southeastern England. White 'Upper Chalk' is a highly porous rock which, by volume, is 40% or more empty and usually air-filled voids. But after saturation with prolonged heavy rainfall it of course contains around 40% water filling the voids, thereby increasing significantly in density. An excess of water also fills cracks and joints in the rock. Masses of chalk in chalk-mine ceilings are thus much heavier than usual, and the cracks and joints between them are lubricated, resulting in roof-falls.

As most chalk mines are at relatively shallow depth, these roof-falls migrate upwards to break surface as 'crown holes' or craters which in the said winter have been appearing in lawns and driveways, and even under houses, newly built in chalk districts. Thus we are reminded that the coalfields and the metalliferous mining regions such as Cornwall do not have a monopoly of abandoned mines. Chalk mines have been tunnelled under, for example, Berkshire, Buckinghamshire, Essex, Greater London, Hertfordshire and Kent. Recent press reports have concerned subsidences at Upper Basildon (near Reading), and Nettlebed (South Oxfordshire).

Chalk mines were commonly excavated below brickfields, the brickmaking clay dug from open pits being mixed with chalk from mines below them before being moulded



and fired. Although after the 1872 *Metalliferous Mines Regulation Act*, such mines were subject to government regulation and inspection, surviving records are lacking in detail concerning their exact locations and extent. The requirement of the Act that on abandoning a mine a plan should be filed at the then Mining Records Office applied, unfortunately, only to concerns employing at least 12 men underground.

As most chalk mines, certainly in their final years before closure, had very small workforces, very few abandonment plans were made and deposited. First and second edition Ordnance Survey large-scale plans show late nineteenth-century brickfields, and some actually indicate mineshafts. However, conventions adopted by the surveyors led to shaft tops not open to the air not being marked on the plans. As such shafts were usually under sheds or at least some sort of roofing to keep rain out, so could not be seen from a 'bird's eye view', they were often not mapped.

If you contemplate buying a house on chalk lands in any of the counties mentioned above (and others such as Norfolk and Suffolk) bear in mind the 'chalk-mine problem' and at least look at the early OS large-scale plans to see if your possible new home is on an old brickfield site! If it is, further in-depth research into the site history is advised.

Readers will have noticed that Surrey and East and West Sussex have not been mentioned, although all three counties of course have extensive chalk downland within their borders. It is a curious and as yet unexplained fact that little or no chalk mining has been recorded in these areas. Surrey and Sussex have been credited with some actual or suspected denehole (medieval chalk mine) shafts, but they seem to have been far less common than in Essex and Kent. There are underground chalk quarries (for building stone) at Mickleham and Guildford (Surrey), but no extensive pillar-and-stall chalk mines are (yet) known in the county. Why this should be is a puzzle!

SOURCES:

HUGHES, Peter, 2014, Old mine workings thought to have caused sink hole. *Oxford Times*, 27 February 2014, page 8 [Nettlebed (South Oxfordshire): 4m wide sinkhole opened on 7 / 8 February 2014 / there had been an earlier one nearby in 1990 / thought to have been caused by chalk mines]

MILLWARD, David, 2014, Mines: hole appeared in driveway: car damaged by 8 ft. crater. *Get Reading*, 14 February 2014 [Upper Basildon: 8 ft wide x 8 ft. deep at the location of the former Basildon Brickyard and Kiln worked c. 1850s–1900 / thought to be subsidence into abandoned chalk mines]

Corsham's mines could become Europe's largest data reservoir

Part of a UK Government investment programme will include the creation of the Alan Turing Institute. Alan Turing is probably most celebrated for his work at Bletchley Park during the Second World War, where he worked for the Government's Code and Cypher School, devising various techniques to break German ciphers,

including the electromechanical machine that could find settings for the Enigma machine. Winston Churchill said that Turing made the single biggest contribution to Allied victory in the war against Nazi Germany.

He was a British mathematician, logician, cryptanalyst, philosopher, computer scientist, mathematical biologist, as well as a marathon and ultra-distance runner. His work was extremely significant in the development of computer science, producing the Turing machine – a forerunner to today's personal and mobile computers.

So how will Corsham follow in his significant footsteps? Jeffrey Thomas, of the Corsham Institute, explains, "As a society we are producing more data than ever before, from every time we switch on the kettle and update our social media, somewhere these transactions and interactions are stored. We call this Big (and Fast) Data and cracking Big Data is similar to cracking the Enigma.



Tunnel Quarry at Corsham, Spring Quarry is at the top of the slope. Photo Nick Catford

"The work currently being undertaken by the Corsham Institute continues Turing's work and the genius that was performed at Bletchley Park. Beneath Corsham our partner, Ark Data Centres, holds a million square feet of secure, sustainable space in the old Bath Stone quarries, which lends itself perfectly to store all this data, ready for when analysts need to access it."

Professor of Cryptology Nigel Smart, from Bristol University, explained about Big Data in a recent BBC interview, "We are producing data at a rate unprecedented in human existence. We'll have more information about what everybody is doing, or what things are doing, so we can analyse this data to benefit the man in the street or society as a whole."

SOURCE:

<http://harthampark.com/news/following-in-alan-turings-footsteps>

The wet winter of 2013/2014 and mining subsidence

British Geological Survey geologists have reported that the number of sinkholes appearing in the UK in February 2014 was around three times the national average number



for a 'normal' year. They occur especially on the outcrops of the four water-soluble rocks found, predominantly, in England: chalk, gypsum, limestone and rock-salt.

They may be the result of natural solution of the rocks by rainwater, but are often related to shallow mining: the two scenarios are not always easy to distinguish. The chalk of southeast and southern England was particularly prominent in the list of subsidence events in the last year. SOURCE: NELSON, Sue, 2014, That sinking feeling. *Planet Earth*, Summer 2014 [*Planet Earth* is published by the Natural Environment Research Council]

Cornish tungsten mine to reopen

An Australian firm is pressing ahead with its plan to develop a tungsten mine near Plymouth. Wolf Minerals has received the first part of a £52m funding package, which was signed off last month. It means the long-delayed purchase of fifteen homes around the mine site can proceed.

Wolf wants to begin mining by the end of 2014 and expects the site at Hemerdon to be the "world's next major tungsten mining operation". It is believed to be the fourth largest tungsten resource in the world and the company hopes to produce about 3,000 tonnes of tungsten and tin a year. A £75m contract to build the new mine plant is also beginning.



The WWII mill at Hemerdon

Tungsten, which is used the production of alloys and steels as well as armaments, light bulbs and as ballast for racing cars, was discovered at Hemerdon in 1867. Mining was carried out there between 1919 and 1920 and again from 1934 to 1944, when production ceased. The plant was kept in place after the war, and the government was rumoured to have planned restarting production during the tungsten shortages associated with the Korean War. However, nothing came of this and following the Westwood Report in 1956, the government decided to seek a private partner to move the mine's development forwards. After further decreases in the tungsten price, resulting in the closure of the Castle-an-Dinas Mine tungsten mine in Cornwall, the government sold off all the plant in 1959.

SOURCE: *BBC News - Devon*, 12 June 2014

Spontaneous combustion at Daw Mill colliery, Warwickshire

Spontaneous combustion in a coal seam at Daw Mill deep colliery, Warwickshire, resulted in an underground fire that was deemed to be beyond economically practicable control. The mine was closed, and the two shafts backfilled. However, an inclined drift remains open, and monitoring in it has detected carbon monoxide and smoke still issuing from the fire.

SOURCE: CARR, Robert, 2014, Daw Mill colliery. *Industrial Archaeology News* 168

Hatfield colliery landslide and rail freight traffic, South Yorkshire

Heavy freight rail traffic was seriously impeded when a colliery spoil tip at Hatfield, near Doncaster, South Yorkshire, caused an estimated 1.4m tons of material to slide onto the line. Around 140 heavy freight trains carrying aviation fuel, coal, oil and steel each day had to be rerouted. The line in question links Doncaster with Cleethorpes, Goole, Grimsby, Immingham and Scunthorpe.

SOURCE: CARR, Robert, 2014, Hatfield colliery tip. *Industrial Archaeology News* 168

Coal mining might be returning to Whitehaven, Cumbria

The Haig Pit in Whitehaven was shut in 1986 after 70 years with the loss of 3,500 jobs.

Now, the West Cumbria Mining Company is investing £14.7m in a study to examine whether coking coal could be extracted close to the site. The firm believes there could be as much as 750m tonnes available in a 75 sq mile area around the colliery.

The UK is currently a substantial net importer of coking coal for industrial use, the majority of which is sourced from Australia and the USA. It therefore makes economic sense to source available coking coal from the UK if sufficient amounts can be accessed and mined economically. The company believes that mining has the potential to bring significant economic benefits to the local area in the future, including high-quality new jobs. Cumbria County Council will decide on whether to give planning consent to exploratory drilling, the main mining



Haig colliery in 1972 during the last days of steam on the NCB.
Photo Gordon Edgar



operation and any necessary remediation work, once plans have been submitted.

The rebirth of mining in West Cumbria would be a massive boost to regeneration in the area. Limited onshore test drilling is due to start later this year, with offshore tests in 2015.

SOURCE: *BBC News - Cumbria*, 10 June 2014

What future for Hatfield, Killingley, and Thoresby deep collieries

The futures of Britain's three surviving deep coal mines may be threatened by new financial arrangements to be introduced in connection with the Government's target for reduced carbon dioxide emissions responsible for climate change.

SOURCE: GOODLEY, Simon, 2014, UK's last miners look to an uncertain future: thirty years on from the strike, will emissions be the final nail in coal's coffin? *The Guardian*, 5 March 2014

Goodluck Mine Preservation Group, Derbyshire

The small Goodluck mine under Middleton Moor near Cromford in Derbyshire was worked for galena (lead ore) from 1830 to 1952. When the mine closed the then



Good Luck mine adit c 1950s

owners dynamited the entrance to prevent further access. Under Derbyshire mining laws, the newly constituted Goodluck Mine Preservation Group obtained ownership and cleared the mine entrance, removing 30 tons of rubble, in 1974. The mine was found to be in good order, with much of its equipment preserved intact. The Group now organises 90-minute guided tours underground on the first Sunday each month and at other times by appointment. For further information visit www.goodluckmine.org
SOURCE: The Goodluck Mine Preservation Group, 2014. *Current Archaeology* 25 (4)(292), page 50.

Milwr Tunnel remains closed

United Utilities have (19 June 2014) informed the Grosvenor Caving Club, which has an access agreement, that in line with that agreement, access is denied until further notice as they will 'shortly' be restarting inspections and engineering work at the portal end of the Milwr Tunnel. Previously United Utilities had simply denied the use of their shafts or other 'assets'.

Grosvenor Caving Club then re-entered the system using alternative agreements and permissions. GCC apologises to those who had hoped to visit the Milwr tunnel in the near future. Further information may be obtained from the Access Officer. S_G_Brown@tiscali.co.uk

SOURCE: Grosvenor Caving Club

Conservation work at King Edward Mine, Cornwall

A grant of £1.2m has been made by the European Regional Development Fund for the restoration of surface buildings at King Edward Mine, near Camborne, Cornwall. Subterranea Britannica members visited the site during the Cornwall Study Weekend in September 2010.

SOURCE: THORNE, Graham, 2014, King Edward Mine, *Industrial Archaeology News* 168

Updated inventory of metal and gangue mining sites in the Peak District

The Peak District was an historically very important source of metals, especially lead and copper (mostly in Derbyshire, but copper in Staffordshire). More recently the other minerals occurring in the same deposits as the lead and copper ores, including barite, calcite and fluorite (discarded as useless by the metal miners) have become of economic importance in their own right.

These 'gangue' minerals have been exploited by excavating them from the old metal mine waste tips. Heavy earthmoving plant brought in for this purpose has had a serious impact on the archaeology of the mine sites. This comprehensive inventory considers the present state of the most important of these sites, and documents the geological context, archaeology (surface and subterranean) and ecology of each one. There is a comprehensive and detailed list and index of features, glossaries of technical terms, and six pages of bibliographical references.

SOURCE: BARNATT, John, Kieron HUSTON, Dave MALLON, Rebekah NEWMAN, Rebecca PENNY, and Richard SHAW, 2013, The lead legacy: an updated inventory of important metal and gangue mining sites in the Peak District. *Mining History [Bull. Peak District Mines Historical Society]* 18(6)

NEWS – MISCELLANEOUS

Orkney wartime oil tank reuse being considered

A project that could see underground oil tanks built during World War II brought back into use is set to be launched in Orkney. Banffshire-based Northern Oils is to see if the six tanks could be used to store and supply marine gas oil. Work on the underground oil tanks in the Orkney island of Hoy began in 1938. They were built into the hill above the naval base at Lyness to protect them from German air raids. The six tanks were capable of holding more than 130 million litres of fuel oil – but have lain empty for decades.

Northern Oils sees them as an ideal base for a fuel distribution hub for its customers both in the UK and across northern Europe. An agreement with Orkney Islands Council will see the company spend a year





The southeast entrance tunnel behind Wee Fea. Photo Martin Briscoe investigating the viability of the project.

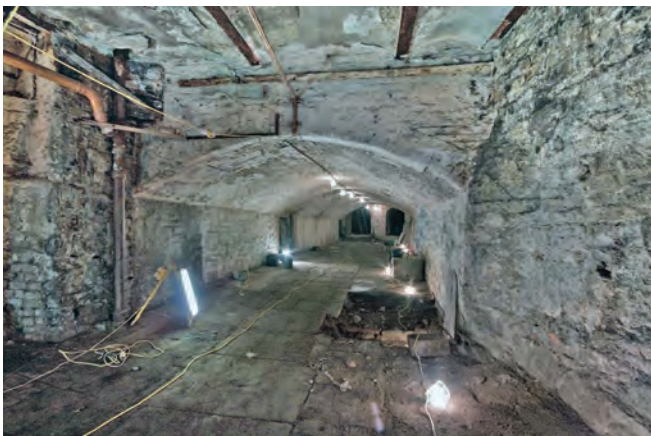
The council has given the company twelve months to find out if the tanks are fit for purpose. Initial inspections had shown them to be in remarkable condition.

SOURCE: *STV News*, 18 July 2014

Victorian-style underground market planned for Bradford

The ‘Bradford Tunnel Project’, the brainchild of Graham Hall, of Yeadon-based developers Sunbridge Wells Ltd, would see a maze of tunnels under Ivegate, Upper Miller Gate and Sunbridge Road in Bradford turned into a contemporary space with two new bars, a restaurant and twelve retail units.

The 12,000sq ft application site, formerly a prison, air-raid shelter, plumber’s yard, brewery and nightclub down the years, is situated in the City Centre Conservation area, with proposed access via City Park and Sunbridge Road. All the buildings involved above ground level are Grade Two listed, and the developer states it will ensure the character of the Victorian structures remains. There would be Victorian-style units running along the tunnel’s internal street with a large glass area above.



One of the cleared tunnels

A courtyard would have an open-plan glass and steel staircase leading to Upper Miller Gate. This would be designed to bring light to the tunnel system, covered by a Victorian-style atrium entrance and exit to the shopping area below.

Students at Bradford College have been involved in designing potential interior units for the shops, and Mr

Hall said a number of firms had already shown interest in renting the space.

490 tonnes of timber and rubble have already been removed from the tunnels, and if the planning is approved work can start immediately and should be finished and open for Christmas this year.

More information and many pictures will be found on their web site: www.sunbridgewells.com

SOURCE: *Bradford Telegraph & Argus*, 4 July 2014

NEWS – TUNNELS AND TUNNELLING

\$125 million dollar rescue of the world’s largest tunnel-boring machine underway in Seattle

Sometime this autumn, a huge vertical shaft lined with 84 concrete pilings, designed to hold back the slurry that defines underground Seattle, will be finished, and a Mr Fix-It operation unlike any other will begin.

The world’s biggest tunnel-boring machine, nicknamed ‘Bertha’ – which hit a pipe and was damaged in mid-December after only 1,000 feet of excavation – is down there in the dark, awaiting what may well be the world’s biggest industrial rescue operation.

If all goes according to schedule, tunnel work could resume next March, sixteen months after tunnelling was stopped. Until then, the rescue itself – the cost of which, along with delays, could surpass \$125 million – has become its own drama within the broader saga of the tunnel.



A section of the tunnel excavated by Bertha

Engineers around the world were closely watching Seattle’s tunnel even before Bertha ran into big trouble. At 57.5 feet Bertha is the largest-diameter tunnel-boring machine ever built. She was designed to dig under Seattle’s waterfront to allow the city to replace an ageing viaduct. The project was given urgent priority after an earthquake in 2001 revealed instability in the elevated roadway, which was built in the 1950s. Tearing down the viaduct will also open up the city’s waterfront to new development.

What exactly happened to Bertha, as it moved forward on its 9,000-foot journey, is in bitter dispute, with huge dollar totals at stake. The tunnel’s contractor has argued that a



buried eight-inch-diameter steel pipe in the machine's path led to problems of grit and rock infiltrating the seal and bearing system, but state transportation experts believe the pipe had nothing to do with the trouble at all.

The rescue operation began in late Spring with construction on the shaft to reach Bertha. Workers have been sinking pilings in a ring to prevent the shaft from collapsing, using 24,000 cubic yards of concrete. Once that ring is complete, digging on the shaft will start.

When the shaft is ready, Bertha, which is damaged but still operational, will be turned back so she can chew through the concrete pilings to reach the centre of the shaft. There, the machine will rest on a cradle where workers can detach the front end and hoist it out.

SOURCE: *New York Times*, 1 August 1914

London Underground uses a disused station shaft for Central Line track renewal

A disused 33-metres-deep lift shaft at the former Post Office Station on the London Underground is being brought back into temporary use by contractors renewing track on a 14 miles length of the Central Line. Supplies and equipment are lowered to track level at this site near St Paul's Cathedral, and waste and rubble removed, between the last services of the night and the first the next morning, so between around 01.00 and 05.00 each day. The shaft has been out of use since the station closed in the 1930s, apart from accommodating offices for the Central Electricity Generating Board during World War II.

SOURCE: ANON, 2014, Old Post Office Station revived. *Modern Railways* 71(790)

Hot weather reveals entrance to 'secret tunnel' at Mountfitchet Castle in Essex

The search for a secret tunnel, rumoured to exist under Stansted's historic Mountfitchet Castle may finally be at an end.

According to the owners of the 1066 landmark, one of the hottest July's on record in Essex has revealed the outline of its entrance, scorched into the grass within the reconstructed motte and bailey compound.

For many years the search has been on for the entrance to a secret tunnel, but it has always eluded historians. Elderly residents remember this tunnel from before the war as very young children, and being prevented from entering by an iron grille which was consequently covered with earth, sealing the entrance and location forever.

The hot weather has revealed the outline of the entrance to this tunnel and at last it seems the mystery may now be solved. No one is sure where this ancient tunnel may lead to and what treasures and interesting artefacts may lie at the end of it.

The castle dates back to an early Iron Age fort and then a Roman, Saxon and Viking settlement. In 1066 the site was attacked by the invading Normans and Robert Gernon, the Duke of Boulogne, built his castle here, making it his chief seat and the head of his barony. Robert Greno;

as he is referred to in the Domesday Book, came over from France with William the Conqueror, rumoured to be his relation, and was rewarded with this lordship and several others in the county.

A later owner, Richard de Montfitchet II, was one of 25 barons chosen to enforce the observance of Magna Carta. Richard died in 1258, having gained royal favour under Henry III, but he lacked heirs as he apparently never married and the Montfitchet possessions were divided among his three sisters, thus bringing an end to the reign of the Montfitchets.

The castle had been attacked by King John in around 1215 and then its stones were taken by the villagers to build their homes, leaving the site to fade into obscurity for seven hundred years until it was reborn as a tourist attraction.

SOURCE: *Herts & Essex Observer*, 2 August 2014

Conservation management of underground stations: London

An interesting recent paper by the former Head Curator of the London Transport Museum reviews the fate of London Underground infrastructure, fixtures and fittings, and machinery and rolling stock. The surviving legacy of the early underground and tube railway companies, and of them jointly on amalgamation into London Transport in 1933, is considered.

Periods of neglect have resulted in historic features surviving for want of funds to modernise. Periods of modernisation have resulted in destruction of heritage features. With the establishment of the London Transport Museum, and with the introduction of Listing and Scheduling to the Underground, and more enlightened management, historic features are now better cared for and, in some cases, restored or replicated.

SOURCE: GREEN, Oliver, 2014, The archaeology of the Underground: a future for its past. *London's Industrial Archaeology* 12

World's shortest air route could be replaced by a tunnel

The world's shortest scheduled flight could end because of a £300 million scheme to link the Orkney Islands together by tunnels, bridges and causeways.

The 1.7-mile route between Westray and Papa Westray has become famous around the world as the flight takes just 52 seconds. The record-breaking brevity from the wheels coming up to touching down again attracts aviation fans from around the world. But Orkney Islands Council is considering new ways to link seven islands and the airfields on Westray and Papa Westray may close.

SOURCE: *Scottish Express*, 13 June 2014

Maintenance of engineering assets of underground railways, London

The London Underground transport system, comprising surface lines and structures alongside cut-and-cover and deep-bored tunnels, has developed from the 1860s onwards by the amalgamation of a number of private



companies and, since 1933, various reorganisations resulting from political intervention. There was no overall standard design, and at each organisational change engineering drawings and condition records have been lost or intentionally destroyed.

Less than forty percent of record drawings have survived, along with materials specifications, design calculations, and loading data. A comprehensive scheme to assess the exact nature and condition of the entire system, component by component, has been introduced since the mid-1980s. This has revealed that, to a large extent, everything was done, for commercial reasons, 'on the cheap'. There is now a standardised asset inspection and recording regime, the development of which has been described in a paper by Graham Bessant.

SOURCE: BESANT, Graham, and Richard McKOY, 2013, London Underground: unravelling 150 years of structural secrets. *Civil Engineering* 166(1), 27–34

Anniversary of flood relief scheme in Somerset

With the recent floods in Somerset making the headlines across the world, it is a reminder that 2014 will be the fortieth anniversary of a scheme that finally put a stop to major flooding problems in Midsomer Norton.

In 1974 engineers came up with the answer to the floods which had plagued the town for decades, regularly turning the High Street into a river and causing misery for shopkeepers and householders. The River Somer, which cuts through the town, had become a bottleneck at times of high flows of water, particularly after heavy storms and between 1954 and 1979 when shops in the High Street were flooded sixteen times.

The damage caused to property in the town by flooding between 1960 and 1979 was in excess of £5 million. In 1974, the same year the town experienced two of its worst floods, engineers came up with the answer: a 1.1-kilometre tunnel taking flow away from the town centre.

In March 1977 work began on the relief tunnel. Engineers used a specialised boom cutter to excavate part of the tunnel, 11 metres down at maximum depth. About 11,000 cubic metres of material was excavated and passed back along the tunnel on a conveyor belt, to be dumped on fields downstream. Within the steel lining of the machine housing, a 2.75-metre diameter tunnel was formed from precast segments, using more than 1,000 cubic metres of concrete.

The work was finished in 1989 at a cost of £1 million. The work ended in style when one workman reached through the last remaining gap in the rock to shake the hand of an engineer.

SOURCE: *Somerset Guardian*, 3 July 2014

History of London's sewerage before the work of Sir Joseph Bazalgette

London's main drainage system, perfected by Sir Joseph Bazalgette (1819–90) in the years 1858–1875 had its origins in the work of painter John Martin (1789–1854)

in the 1830s when the better-known man was still a boy. A paper published by the Institution of Civil Engineers in its journal *Engineering History and Heritage* describes the initial evolution of a plan for the capital's sewerage system from open ditches and cess-pools periodically emptied by 'night soil men' to the network of sub-surface pipes and tunnels developed by Bazalgette.

From 1828 Martin developed proposals for an uncontaminated piped water supply from the River Colne and from the Thames above Teddington Lock. His plans, submitted in 1834 and 1838, envisaged improvements to London's drainage and the exclusion of sewage from the Thames, and the organised collection of 'night soil' for use as an agricultural fertiliser.

It was his proposal, later realized by Bazalgette, to construct sewers either side of and approximately parallel with the river to intercept foul water and conduct it to Limehouse and Rotherhithe (areas which were of course later to be engulfed by the expanding city). He also suggested the construction of settling tanks in which suspended particulate matter was to be separated from the watery component, the two to be processed separately – standard practice today when aerobic and anaerobic treatments are used.

SOURCE: GATERELL, M., 2012, The art of John Martin's London sewerage system. *Engineering History and Heritage, Proc. Institution of Civil Engineers* 165 (EH1)

Snow Hill tunnel, Birmingham

Railway historians are notorious in their assiduity in accumulating obscure and otherwise forgotten facts. A splendid example is provided in a recent *Bulletin* of the Railway and Canal Historical Society, gleaned from the *Journal* of the Stephenson Locomotive Society 90 (886) (2014), page 53.

The Bank of England was authorised by the *Country Bankers Act* of 1826 to open railway branch lines, and in due course seventeen were opened: two in London, a short-lived one in Swansea, and the remainder in provincial England. The other lines were in Birmingham, Bristol, Hull (closed in 1940), Leeds, Liverpool, Manchester, Newcastle, Plymouth (closed in 1949) and Southampton (opened in 1940). None now survives.

The Birmingham branch line was of interest in that it diverted from the Great Western Railway's main line part-way through Snow Hill tunnel and led to a siding under the Bank's premises to allow for secure transfer of bullion direct to the vaults.

The bullion vans were attached to the tail ends of down GWR expresses, and detached at Snow Hill station (the once grand GWR station survives, modernised, to serve only local services). The station pilot (a small shunting locomotive) was then coupled to the van which was taken back into the tunnel and thence to the siding.

Whether this siding was an additional line laid in the tunnel itself, or a separate branch tunnel, is not stated in



the source cited. As an additional security measure, GWR bullion vans had doors on one side only, and were so routed that the doors did not face onto public access station platforms. This little-known operation is thought to have survived into the 1960s, possibly indeed until the London Paddington–Birmingham service was withdrawn in 1967. Your scribe’s first arrival in Birmingham was at Snow Hill (en route for Dudley and the limestone mines) in or about 1962, but was quite unaware of this curious aspect of the Snow Hill tunnel (not to be confused with the tunnel of the same name still in passenger use in London).

SOURCE: BANK OF ENGLAND, 2014, As safe as the Bank of England. *Bull. Railway and Canal Historical Soc.* 450

Disused Yorkshire railway tunnel could become the longest underground cycleway in Europe

In June 2014 Transport Minister Robert Goodwill visited the Queensbury tunnel which shut in the 1960s, but has recently been part of a push to create a cycleway that would link Bradford and Halifax.

The Queensbury Community Heritage and Action Partnership (Q-CHAP) believes the mile and a half long tunnel could become the longest underground cycleway in Europe, and build on the *Tour de France* legacy by bringing tourists and cycle enthusiasts to the area.

Mr Goodwill has recently said that more disused tunnels have the potential to become cycleways, so the group hopes to get some high-profile backing for its campaign.

Joining the minister on the visit were Gary Verity, the chief executive of tourism group *Welcome to Yorkshire*, who was responsible for bringing the *Tour de France* to the county in July, and Councillor Val Slater, Bradford Council’s portfolio holder for planning and transport. The visitors were told about ambitious plans for the tunnel, which include annual sporting events.

The tunnel, which opened in the 1880s, but now lies derelict and partially flooded, is owned and operated by the Highways Agency, which has a budget to make the structure safe and will soon be undertaking a survey to find the best way to do this.



The flooded south portal of Queensbury tunnel in 2010. The water level was low that year; the portal was usually completely under water.



The south portal of Queensbury tunnel in 2012 after the water had been pumped out of the Strines cutting to allow maintenance of the tunnel.

Q-CHAP believes that this money should be used to reopen the tunnel, rather than block it. To the north of the tunnel is the Great Northern Cycle Trail, created by transport group Sustrans and the local Council. The hope is that the tunnel could extend this trail, which currently links Bradford and Cullingworth.

Sustrans, which recently opened a similar cycleway in a disused Bath tunnel, has voiced support for the tunnel idea, and 2018 will be the 140th anniversary of the tunnel’s opening. Given the go-ahead, Q-CHAP thinks Bradford and Halifax could become proud joint hosts to a fantastic new sporting event – the Queensbury Tunnel Triathlon.

SOURCE: *Bradford Telegraph and Argus*, 20 June 2014

Holme rail tunnel reopened after upgrading, Lancashire

The double-track Holme tunnel (250 metres), on the Burnley to Hebden Bridge line, reopened to traffic on 24 March 2014 after a 20-weeks closure for realignment and strengthening. Ground movements had resulted in the gradual development of misalignments in the tunnel structure.

SOURCE: ANON, 2014, Holme tunnel life extended. *Modern Railways* 71(788).

Two historic tunnels found in Dorchester

A legendary tunnel has been uncovered underneath a Dorchester shopping street. The passageway used by the notorious Judge Jeffreys, who instilled widespread fear during the Bloody Assizes of 1685, has been rediscovered underneath Antelope Walk by its caretaker and keen archaeologist and historian Terry McGrath.

The tunnel is said to be wide enough for three judges to walk side by side, and ran from Judge Jeffreys’ lodgings in High West Street to the Oak Room tea rooms, the site where he held his brutal court more than three hundred years ago. The network of tunnels is also believed to connect to the town’s famous Old Crown Court and cells, which are due to be redeveloped as a major tourist attraction.

It is hoped the tunnels will be opened up to give public access and celebrate another intriguing piece of



Dorchester's rich and sometimes dark history.

George Jeffreys, First Baron of Wem and Lord Chief Justice, became famous for the ruthless streak he displayed during the Bloody Assizes that followed the Monmouth Rebellion in 1685. The Duke of Monmouth was executed after a failed attempt to overthrow the king and a series of trials were held across Winchester, Salisbury, Dorchester, Taunton and Wells to send a message to supporters of the rebels.

Not satisfied in funding one tunnel, with help from Dorchester town councillor David Taylor, Terry has now rediscovered the entrance to a tunnel he first found 25 years ago from the River Frome to the prison. After he first found the tunnel he was forced to keep quiet about its existence as the prison did not want it publicised that there was a potential escape exit from the jail.



Judge Jeffreys' tunnel

But after the closure of the prison last year he decided it was time to see if he could find the entrance again. He first read about the tunnel in an old book that described that when the river was low, prisoners would enter the tunnel and clean the filter beds.

When he first found the tunnel, it was gridded and further investigation was prevented as the tunnel went under a secure prison. The book's author suggests that the tunnel was there before the Victorian jail was built. Thorough archaeological investigations will now be carried out before any further work commences.

SOURCE: *Dorset Echo*, 2 July & 10 July 2014

Crossrail 2 route options, London

With Crossrail 1 well on the way towards completion, providing for through main-line rail travel east-west across and under central London, proposals for a second such line are now actively in course of formulation.

Crossrail 2 is to provide for through rail travel between northeast Surrey and the southwestern London suburbs and south Hertfordshire. Consultations are to be held on possible routes between Epsom, Surbiton and Twickenham in the southwest and Alexandra Palace, Hackney and Cheshunt to the northeast. Intermediate central London stations will include Clapham Junction, Victoria and Euston and/or St Pancras.

The new line is needed to provide extra capacity and

relieve overcrowding on existing lines into Waterloo and on the London Underground. A central tunnelled section is expected from near Wimbledon to just short of Tottenham Hale.

SOURCE: ANON, 2014, Crossrail 2 variations, *Modern Railways* 71(790)

Tunnels and the need for an alternative rail line to Plymouth and Cornwall

The main railway line from London Paddington to Plymouth and all parts of Cornwall was severed by the destruction of the sea wall at Dawlish by a storm during the night of 4 February 2014. Freight trains and the overnight sleeper trains to and from Penzance could not run for two months, and passengers on day trains had to be conveyed by buses bridging the gap. The breach in the sea wall has been repaired, and rail services recommenced on 4 April.

There was, until it was closed to through trains in 1968, an alternative rail route between Exeter and Plymouth: this ran around the north side of Dartmoor, via Okehampton and Tavistock (Devon). There have been numerous demands over the years for this line to be reopened to rail traffic and, indeed, part of it remains open for freight trains from Meldon quarry, and another part still conveys local passenger trains between Plymouth and Gunnislake. Twenty-one miles of abandoned track between Meldon and Bere Alston would have to be restored to use,

However, restoring the route via Okehampton for main-line traffic would be no help to important south Devon seaside towns such as Torquay and Paignton. Attention has therefore been turned to the possibility of a new inland route, away from the vulnerable one along the foot of the cliffs at Dawlish, from Exeter to Newton Abbot (bypassing Teignmouth).

Both proposed new alternative lines would have to negotiate the high ground of the Haldon Hills. Both would divert from the existing main line at Exminster, one running direct to Newton Abbot, the other taking a longer route further inland via Chudleigh and Teignbrace. The most direct of these two routes would call for a new seven mile tunnel.

A third option put forward envisages reopening of the 15 ¼ miles of closed track along the former Teign Valley route between Alphington and Heathfield near Newton Abbot. The problem in this case would be the 829-yard Perridge tunnel which is currently blocked by an internal rock fall which would have to be cleared.

The Dawlish route was not the first coastal line in the British Isles to be severed by storm erosion. In the nineteenth century the cliff-side line at Bray Head on the Dublin to Rosslare line in Ireland had to be bypassed by an inland route including the 1084-yards 'Long tunnel' engineered by Isambard Kingdom Brunel. Coincidentally, Brunel had also been responsible for the South Devon Railway via Dawlish.

SOURCE: DUDDRIDGE, Gerard, 2014, Trains run again at



Dawlish but what about the stormy future? *Railwatch* 140; and HUNTER, R.A., 2014, Brunel in Ireland. *Railwatch* 140, page 8.

Power cable tunnel could be built under Morecambe Bay

National Grid is looking to install new power cables in a bid to connect a proposed nuclear power station in West Cumbria and a number of offshore windfarms to the grid. The project will mean a major overhaul of the existing network, and National Grid has revealed its preferred option is to install new cables from West Cumbria to Carlisle and new cables from West Cumbria to Heysham via a massive underwater tunnel across Morecambe Bay. National Grid said there were no plans to incorporate any kind of transport system for vehicles as part of the tunnel. Other possible routes include new cabling across South Cumbria from west to east and an offshore route which would go out into the Irish Sea before coming back on land at Heysham. Work is not expected to start until the next decade.

Although an estimated cost of the project is yet to be confirmed, it is believed it could cost as much as £3bn.

National Grid has been working on the project for the last five years, with concerns being raised about the project's potential impact on the Cumbrian landscape. In September, National Grid will embark on a consultation process.

SOURCE: *North West Evening Mail*, 17 July 2014

Subway modernisation, Glasgow

Glasgow's venerable underground railway is being modernised. It consists of two six-and-a-half-mile concentric tunnels forming a double ring around the city centre, and passing twice under the Clyde. This is a small-scale affair, the tunnels having a diameter of only 11 feet, and a track gauge of four feet. There are 15 stations. The subway opened in 1896 and was worked by cable haulage until 1935 when it was electrified. The last modernisation saw the system closed for three years 1977–1980.



Copland Road station in April 1976 before modernisation

Most of the stations, lacking surface buildings, are quite inconspicuous elements in the Glasgow street scene, with the exception of the flamboyant one housing the headquarters and control centre in St Enoch Square.

Curiously, none of the subway stations serves directly Glasgow's two remaining main-line stations, Central and Queen Street. When first opened, there were subway stations serving the now closed main-line termini at Buchanan Street and St Enoch.

SOURCE: STRATHCLYDE PARTNERSHIP FOR TRANSPORT, 2014, Driverless trains for subway. *Modern Railways* 71(790)

New rail tunnel for the line used by the Glacier Express, Switzerland

A popular 4m-gauge Swiss rail line, much used by tourists, running from Chur to St Moritz, is to have a new 5.86-kilometre tunnel, to replace the existing 5.865-kilometre Albula tunnel bored in 1903.

The new tunnel will be around thirty metres to the northeast of the old one, which will be retained and provided with twelve linking cross-passages every 425 to 460 metres for works access and an emergency escape route. Driving the new tunnel is expected to take six and a half years, with breakthrough in 2017 and trains running in 2020.

SOURCE: ANON, 2014, Switzerland: new Albula tunnel for Rhätische Bahn. *Modern Railways* 71(790)

History of mainland Europe's first underground electric railway, Budapest, Hungary

It is well known that the world's first underground railway was constructed in London, the Metropolitan line being opened through Paddington, Baker Street and eastwards in 1863. It was worked by steam locomotives into the early years of the twentieth century.

Also well known is the former City & South London Railway, the first part of which ran from a terminus near the present Monument LU station, southwards under the Thames to London Bridge. That was the world's first deep-level underground electric railway opened in 1890: the northern end was by-passed early last century by what we know today as the City branch of the Northern line. Budapest, capital of Hungary, is proud to possess the first underground electric railway in mainland Europe, a 3,690-metres line in a cut-and-cover tunnel below Andrassy Avenue, opened in 1896. This line, with several stations, evolved from plans in 1885 for a horse-drawn street tramway, that scheme subsequently being modified for steam haulage before realisation as a sub-surface electrically powered 1435-mm gauge railway built in 1894–96.

The history and development of the line has been described in the Institution of Civil Engineers' journal *Engineering History and Heritage*.

SOURCE: PORRINO, Matteo, 2012, First continental underground electric railway, Budapest 1896. *Engineering History and Heritage*, *Proc. Institution of Civil Engineers* 165 (EH1)

Disused underground stations: New York, USA

Sooner or later, big cities create subterranean urban transit systems to cope with traffic congestion above ground. And, sooner or later, parts of those tunnel systems are



City Hall station in 1904

abandoned or bypassed on account of expansion and new developments.

Sub Brit members will mostly be familiar with the abandoned underground stations in London and Paris, and many of us will have visited some on organised visits. New York also has disused stations. A feature article in *The Observer*, citing the *New York Times* as source, gives some details and impressions of the abandoned Old City Hall station of the sometime Interborough Rapid Transit Company.

SOURCE: FLEGENHEIMER, Matt, 2013, On subways, shadowy glimpses of grandeur and blight glide by. *The Observer*, 15 December 2013 [from the *New York Times*]

Immersed tube tunnels for South Korea and a Germany-Denmark link

Mott MacDonald, an international civil engineering company based in Croydon, south London, has been responsible for tunnelling projects worldwide. A recent issue of the company's house magazine, *Momentum*, contains an interesting article on immersed tube tunnels, of which there are around two hundred now in service worldwide.

Such tunnels are created under rivers or estuaries or under the sea by sinking temporarily sealed reinforced-concrete rectangular box sections (built on shore) into a dredged underwater trench. Manoeuvring the elements out over the water, aligning them all precisely in the trench, forming watertight seals between them, removing the bulkheads and installing services are all tricky procedures, calling in the early stages for the employment of diving personnel.

Offshore installations are especially at risk from strong and variable sea-bed currents. Mott MacDonald have been constructing tunnels of this kind since around the early 1980s. Some details are given for the Busan-Geoje transport link in South Korea. This connects four offshore islands between Gaduk (Busan) and Geoje. Busan is a port city, and Geoje island is a tourist destination and shipbuilding centre. The total tunnel length of 3.2 km has been constructed from 18 box sections, each 180 metres long and 26.5 metres wide, with a displacement of 48,000 tonnes each. The depth of water here was up to 48 metres. The segments were each sealed with temporary steel bulkheads and floated 35 kilometres from the casting yard where they were made.

Currently in prospect is an undersea immersed-tube tunnel

linking the north German coast with one of the southern islands in the Danish archipelago, and the Fehmarn Belt of the Baltic Sea. The total length of this planned tunnel is to be 17 kilometres, with box section elements each 217 metres long and 41 metres wide.

This will be, for the time being, the most ambitious immersed-tube tunnel in the world, and will incorporate in its width two highway tunnels, two high-speed train tunnels, and an emergency escape tunnel. This is intended to replace the existing Puttgarden-Rødby train ferry, which carries trains and road vehicles on the main route between Hamburg and København.

The new tunnel will pass below the busy shipping lane for vessels to and from Kiel. Thirty years in the planning for this fixed international link has seen the bridge option (with separate decks for trains and road vehicles) abandoned in favour of a tunnel. Such a bridge is already in use linking København (Denmark) to Malmö (Sweden) across another arm of the Baltic.

Late News

Woodnesborough Colliery - Kent

Construction of Woodnesborough Colliery was started in 1910 and an extensive range of surface buildings had been erected by 1911 including an engine house, workshops and a chimney but no further work was to be undertaken until a branch from the East Kent Light Railway was completed. By 1914 no sinking had started and at the outbreak of war all further development of the site was halted for the duration. After the war, no further development was undertaken and in 1923 the mine was sold to Pearson & Dorman Long, owners of Betteshanger Colliery. They kept the mineral rights and sold the colliery to the Hammill Brick Co who built a brickworks on the site; this opened in June 1927 and closed in 2008. At this time three colliery buildings remained.

The majority of the buildings on the site have now been demolished, allowing for the development of a small modern hosting estate and the construction of industrial units. Unfortunately in mid-August the colliery winding house was demolished, but the two original colliery workshops are still standing, and they will be refurbished and used as modern industrial units.



The winding house just before demolition in August 2014, with the two workshops to the rear. Photo Colin Varrall



Crystal Palace High-Level Station Subway

Sue Giovanni and Stephen Oxford

The Crystal Palace subway [OS Grid Ref: TQ 337 709] is a beautifully designed and crafted relic of Victorian construction in London SE19, hidden under Crystal Palace Parade, a four-lane road that runs along the top of Crystal Palace Park and is apparently home to little more than a few trees and a bus terminus, oh, and a stunning piece of broadcast engineering known locally as The Transmitter. The Crystal Palace Transmitter can be seen for miles in all directions just as the Crystal Palace itself could when it stood on the same site.

The subway is the antithesis of The Transmitter being underground and completely hidden from view. Despite its secretive aspect the subway is a source of pride for the selection of locals who know of its existence. New visitors are always amazed to find such a spectacular space propping up a main road but remaining out of sight and neglected.



Subway in 1993, reproduced by permission of The Norwood Society, www.norwoodsociety.co.uk

Following many years of regular heritage tours and successful *Subway Superdays* hosted by the Norwood Society and the Crystal Palace Foundation, the subway was closed to the public in 1997 due to concerns about the stability of the brickwork in the courtyard area on the park side. Out of sight was never out of mind, however, and previous enthusiasts did not give up hope of seeing the space restored. Given the location of the subway, a short (possibly drunken) stumble from a main road, it was just a matter of time before a new generation of

locals came across the space and asked the first question everyone asks, “*Why is this space not being used or at the very least why is it not open to the public?*”

This is exactly what happened when two locals, Rolf Peruzzo and Karl Richter, discovered the subway on their way home from the pub. A survey of the space led to a proposal in 2010 for community use of the subway which actually didn’t get very far, but the energy around that proposal did effectively kick-start the Friends of Crystal Palace Subway (FoCPS) who are now actively campaigning to reopen the space.

Since the launch of the FoCPS in 2012 there has been a trial opening of the subway in October 2012 for local people and last year (September 2013) the subway was part of Open House London for the first time. The Open House weekend also saw the launch of a Heritage Lottery Funded project called *Inspired by the Subway (IBTS)* set up to research the history of the space and to gather memories of the subway through oral history recording.

Your authors

Stephen Oxford will share his research work done to date on the earlier history of the subway through to the closure of the High Level Station as well as detailing a bridge load assessment survey from 1997. Sue Giovanni will share information about the more recent uses of the subway obtained both from archives and oral histories; this research in particular has been supported by project researcher Gillian Edom.

1. The birth and death of a station

The Crystal Palace was a famous cast-iron and plate glass building originally erected in London’s Hyde Park to house the Great Exhibition of 1851. After the Exhibition, the building was rebuilt in an enlarged form on Penge Common next to Sydenham Hill, an affluent south London suburb. It stood there from 1854 until its destruction by fire in 1936.

Anticipating the Palace would attract many thousands of visitors, the London, Brighton and South Coast Railway (LBSCR) constructed a line that ran from Sydenham Station to a terminus, later referred to as the Crystal Palace Low Level Station, in the Palace grounds. The station’s platforms were some 100 feet below the level of the Crystal Palace and some 500 yards distant. A covered walkway was constructed to shelter visitors on their walk up to the Palace.

In order to increase the capacity for rail passengers and to enable them to avoid the arduous climb from the Low Level Station, the Crystal Palace and South London Junction Railway was promoted by the London, Chatham and Dover Railway (LCDR); by 1860 the LCDR had a line running to Beckenham Junction via Loughborough Junction, some three miles to the northwest of the Crystal Palace site.

In order to capture traffic from the LBSCR, the LCDR constructed a branch line from the latter station, with a



junction at Nunhead to run directly to the Crystal Palace. This station was known as Crystal Palace and Upper Norwood, later to be referred to as the High Level Station (HLS). The line opened on 1 August 1865. The station was a lavish red and buff brick building with four covered platforms and a turntable. The station was excavated into the ridge below Crystal Palace Parade requiring major engineering works, carried out by Messrs Peto & Betts.



Crystal Palace High Level station looking north c1907; a train from Victoria has just arrived.

The locomotive will uncouple from its coaches and run on to the turntable outside the trainshed at the south end of the station. Having been turned it will run round the outside of the trainshed and recouple to the other end of its train ready for the return journey to Victoria.

In later years there was only a shuttle service between Crystal Palace and Nunhead.

Photo from John Alsop collection

The platforms were level with the machinery basement of the Palace and only thirty yards distant from the Central Transept. There were two sets of booking offices and waiting rooms, one at each end of the building. The first-class passengers were to proceed to the Palace by way of a subway composed of ‘groined arches of coloured brick and stone, resting on eighteen columns of the same materials.’ The corridor led under Crystal Palace Parade to a ‘vestibule roofed with glass and iron and communicating with four staircases, two for entry and two for departure, the style of architecture matching the general design of the Palace as much as possible, the whole ascent from the railway into the Palace is only about 20ft.¹ The subway was illuminated by ‘ornamental gas jets suspended from the key of each arch.’²

The Engineer goes on to claim that ‘the station was designed by Mr Charles Barry, architect, and was built by Messrs Lucas.’ Thus begins the confusion as to which architect designed the subway as *The Morning Post* describes the subway’s materials and style as ‘clearly supporting the concern for the charm of beautiful materials in engineering projects much beloved by Edward Middleton Barry’. However, later in the same article it claims that the architectural firm of Messrs Banks and Barry designed the subway alongside Mr Shelford, resident engineer.

By 1865 Sir Charles Barry had been dead five years so it is likely that the Charles Barry referred to by *The*

Engineer was Charles Barry junior, son of Sir Charles. Indeed, Charles Barry Jr was in partnership with Robert Richardson Banks at this time.

A more reliable source, an obituary of E M Barry, in the minutes of *Proceedings of the Institute of Civil Engineers*³ comes down clearly in favour of both the High Level Station and the subway being designed by Edward Middleton Barry. The obituary says that Edward Barry often ‘lamented the shortcomings of many engineering works in artistic taste and pointed out that there was no necessary incompatibility between engineering necessities of such works and artistic conception. With his knowledge of construction and use of materials, combined as it was in him with great artistic power, he often wished that the union of architectural and engineering professions, securing both the aesthetic and scientific aspect of construction had never been broken.’

Barry’s love of combined skills can clearly be seen in the design and construction of the HLS and its subway. However they do not appear in any of the published lists of works attributed to Edward Middleton Barry.

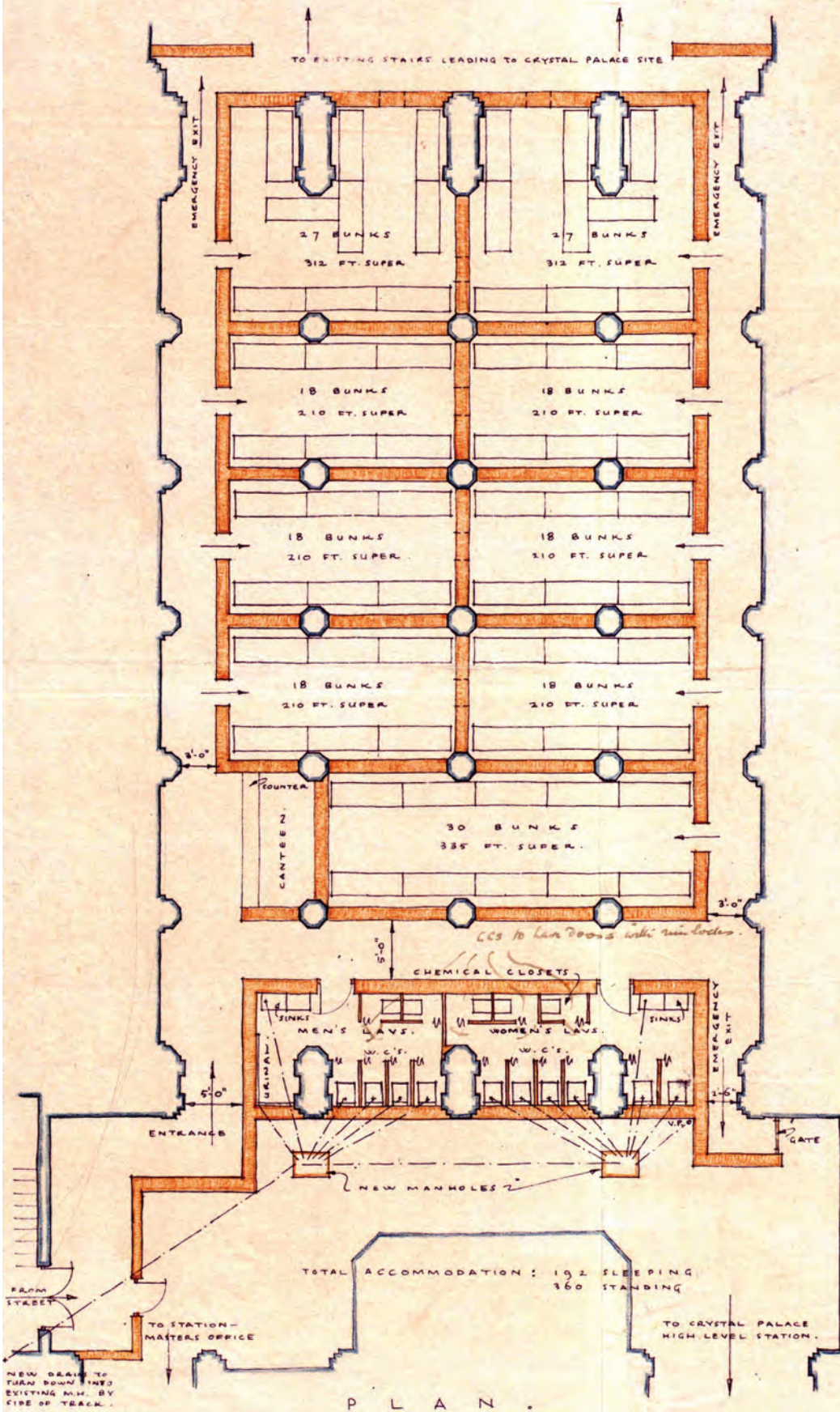
The confusion over the architect continued with its design being attributed to Mr Banister, engineer and Mr Gough, architect, Biney & Pearce.⁴ Furthermore, they said that it was built by Messrs Dove. They cite *The Builder*, no date given, as their source. Charles Barry was again claimed to be the architect in 1982 by Searle.⁵

The builders of the subway are also the subject of some confusion which first surfaces in a lecture to the Dulwich Society in 1969 by Bill de Baerdemaeker.⁶ He stated during the lecture that the ‘magnificent Italian subway that crosses under the Crystal Palace Parade was built in 1861 by Italian bricklayers and stone masons, there being no British bricklayers skilled enough to carry out the task.’ A friend of Baerdemaeker, and Vice-President of the neighbouring Norwood Society, was Alan Warwick who repeats this view in his book *The Phoenix Suburb*.⁷ Baerdemaeker appears to have his dates confused as the subway was not completed for the opening of the station in 1865. The assertion that ‘Italian bricklayers’ constructed the subway reappears up to the present day but does not appear to be supported by any primary source.

Little mention appears in print about the HLS until 1954, when Riley⁸ notes that the station was closed between January 1917 and March 1919, during World War I. The closure led to a loss of traffic from which it never really recovered. Both stations at Crystal Palace were brought under the ownership of the Southern Railway in 1923 and given the names Low and High Level to⁹ differentiate between them. Some

BOROUGH OF CAMBERWELL
 PROPOSED AIR-RAID SHELTER IN SUBWAY AT CRYSTAL PALACE

SCALE OF EIGHT FEET TO ONE INCH



BOROUGH ENGINEER & SURVEYORS' OFFICE,
 TOWN HALL, CAMBERWELL, S.E.5.
 JANUARY 1941

WILLIAM BELL, M.INST.C.E., F.S.I.,
 BOROUGH ENGINEER AND SURVEYOR.

Plans for the subway as an air-raid shelter, reproduced by permission of the National Archive

improvement in traffic was evident after the electrification of the line in 1923.

Riley goes on to describe the further reduction in traffic to the High Level Station following the fire which destroyed the Palace in November 1936, saying its sidings were used to store steam trains used as holiday specials or hop-picking traffic during the summer months.

War brings more changes

During World War II the station was closed from May 1944 until March 1946. The glass roof of the station was much damaged by anti-aircraft fire. After the war no attempts were made to repair the roof and as the northern end was no longer needed to serve the Palace it was allowed to fall into disrepair.

The subway was used as an air-raid shelter during World War II as shown in a number of documents and plans drawn up by Camberwell Council, currently held in the National Archives. Plans drawn up by the Council's Borough Engineer show that it was planned to provide accommodation for 192 people to sleep or for 360 to stand.

The plan shows modifications included partition walls in order to subdivide the subway into nine sleeping areas containing bunk beds, a canteen and men's and women's lavatories. Drains were cut into the floor of the subway to establish necessary connections to the main sewer, which ran below and parallel to station railway lines. Various letters illustrate progress of implementation including an agreement to pay Southern Railway an annual lease of £5. A recent oral history interview by IBTS recorded memories of a conductress from the number



The stairs leading up to the Crystal Palace photographed from just inside the subway, thought to have been photographed by O. J. Morris on 1 December 1936, reproduced by permission of The Crystal Palace Foundation.

London County Council (LCC) had their eye on the subway as in 1964 a beautiful set of survey drawings was produced by a draughtsperson with the initials M.E.W. Described as “Crystal Palace, Sydenham: Subway, Survey of E M Barry vault with associated works”, a detail of one drawing is shown below left.

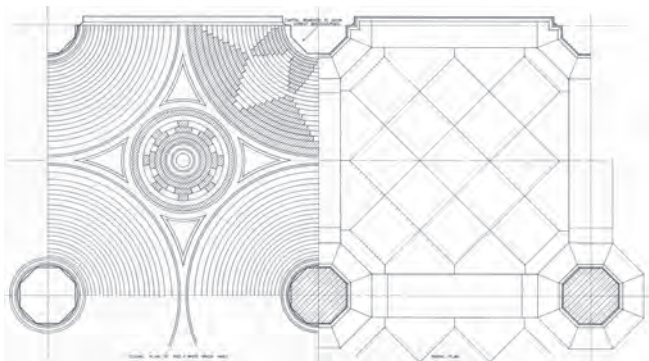
The subway, already a favourite haunt of local youngsters, was only enhanced by a set of wooden steps built to facilitate access to the park when the station site was used as car parking for motor racing and other events. This made the poorly-fenced subway a perfect cut through from the park to track-level wasteland only a short distance from a real adventure, the walk

3 bus who used the canteen facilities in the subway when it was an air-raid shelter. She remembered her and the driver crossing the road and going down into the station after the last bus of the day where they could get a cup of tea.

English Heritage listed the subway in 1972 as a Grade II structure. At that time the stone paving between the subway and the station was ‘largely covered by concrete’. The High Level Station was closed from 20 September 1954 mainly because the revenue from fares would never be enough to carry out the necessary repairs to the track and station buildings. The subway remained but for many years was bricked up, the resulting damp causing damage to its fabric.¹⁰

2. High and dry

Demolition of the High Level Station began in 1961 after a campaign by the *Norwood News* to clean up Crystal Palace Parade. By all accounts the building was in a very dilapidated state and it was of concern to the police, as children were known to be playing in it¹¹. With the station gone, the subway became an underground tunnel between two derelict sites, the ‘Closed Lands’ of Crystal Palace Park and the cleared track-level site of the station opposite.



Crystal Palace, Sydenham: Subway, Survey of E. M. Barry vault with associated works. LCC drawing HB 250 7 dated 11th August 1964, reproduced by permission of English Heritage

through the Paxton Rail Tunnel. This was well known for its S-shaped form making the central stretch pitch dark and quite disorientating.

Several of the oral history interviews conducted by the *IBTS* project have touched on the challenge this walk



The subway terrace on the Southwark side - note some original diamond paving is visible. Photo reproduced by permission of Tony Harden from his collection



The cleared High Level Station site. A lone figure can be seen heading for the railway tunnel. Photo reproduced by permission of Tony Harden from his collection

was seen to be. A flavour of the time can be seen in the photos below left taken in the late 60s from the collection of Tony Harden.

The subway was known further afield with enthusiasts and photographers also visiting, notably Sub Brit's Nick Catford who has photographed the space many times since 1968.

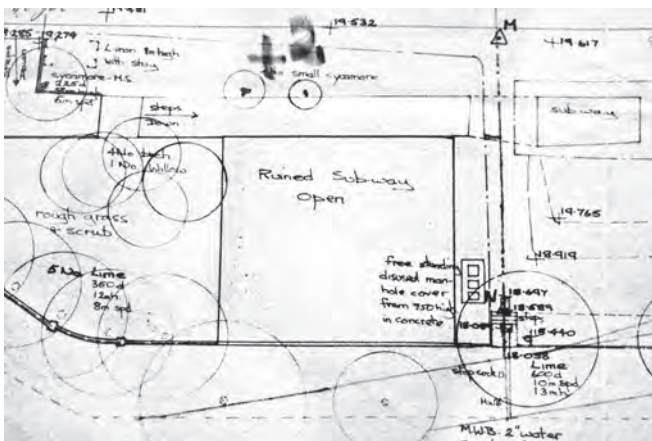


View from the courtyard on the Bromley side in May 1968.
Photo reproduced by permission of Nick Catford



Looking down the main steps on the Bromley side.
Photo reproduced by permission of Nick Catford

Young people and photographers were drawn back time and again to visit the striking space. While the fan-vaulted structure under the road remained in remarkably good condition, the courtyard area on the Bromley side was not so fortunate, with serious damage to the entrance

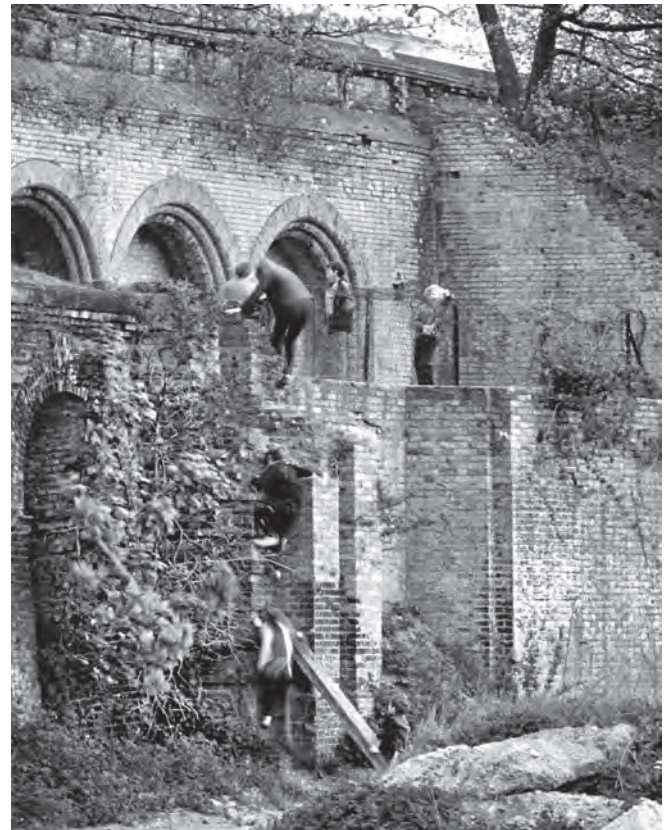


LCC Park Type Development, Survey Drawing 470.72/4,
14th December 1972, reproduced by
permission of London Metropolitan Archive

steps and the Greater London Council (GLC) plans and drawings of the time repeatedly referring to the space as the 'ruined subway'.

The date of listing, 27 September 1972¹² did not prove to be the turning-point in its prospects that might have been hoped for. The 1970s were a busy decade for the subway with suggestions for its use ranging from an aquarium and sculpture gallery, to a pedestrian link between a new housing development and the park; or a home for the London Air Museum¹³.

In 1971 amid fears of vandalism a number of local newspapers reported that the subway was to be bricked-up to prevent residents of the mobile homes on the HLS site from accessing the race track and other parts of the park including the subway.



Young people scaling the former station retaining wall.
Photo reproduced by permission of The Norwood Society,
www.norwoodsociety.co.uk



Prefab houses with the subway in the background. Photo reproduced by permission of Tony Harden from his collection

Standing room only

The bricked-up subway took on a new role as a statue store during the early 1970s. As yet nothing has been found in the archives giving a start date or approval for this use but there is reference to a break-in to the statue store in the GLC documents at the London Metropolitan Archive (LMA); there is also a pastel sketch of statues in the subway by artist Kate Thorpe held at the Lambeth Archives¹⁴, while the photographs below are in a private collection.



Entrance to the bricked up subway on 18 July 1973. Photo reproduced by permission of Melvyn Harrison, The Crystal Place Foundation



The subway in use as a statue store, taken 18 July 1973 by Melvyn Harrison, The Crystal Place Foundation

On 29 September 1979¹⁵ an event was organised by the Crystal Palace Foundation and the Norwood Society to commemorate 25 years since the closure of the High Level Station. The 'Subway Superday' was to usher in a new phase for the subway. It included stalls, information and displays with a highlight being an exhibition about the history of the Crystal Palace¹⁶.

This first event was attended by two thousand people, with an evening cheese and wine party for three hundred¹⁷ accompanied by music, where the acoustics were said to be 'out of this world'.¹⁸ Over the next fifteen years it seems the subway was open regularly for cultural and community events such as the Superday, which by 1986 was billed as having "non-stop entertainment"¹⁹ ranging from street theatre to film.

Use and misuse

Less family-friendly uses of the subway continued too

with one example outlined in a letter from Alan J Watson, Chair of the Crystal Palace Foundation, to Lord Birkett, Director of Recreation and Arts at the GLC. This detailed an incident that occurred when a primary school party visited the subway and came across 'a gang of youths with their heads in plastic bags completely intoxicated from glue vapours and displaying unruly behaviour'.²⁰ This and other complaints about systematic vandalism resulted in Lord Birkett visiting the subway with Allan Tyler, the Area Manager, in August 1980. Mr T G Bidwell, then the Acting Director of Architecture, made various suggestions but the problem centred around the futility of restoration if policing the area with staff or through other means (such as extending the Crystal Palace Caravan Site) could not be improved.

This pattern of use and misuse continued until October 1997 when there was initially a discussion about temporarily closing the subway for 'weights and strains' tests to be undertaken. By October 1997 formal notice of the closure of the subway on a permanent basis had been received by the Crystal Palace Foundation from the London Borough of Bromley (LBB).

3. Tunnel or bridge, bearing the load

In 1997 a survey of the subway was carried out by Bullen Consultants on behalf of the LBB.²¹ This was part of the national bridge load assessment programme to check capacity for 40-ton lorries. As they could find no records of the subway's construction an intrusive investigation was carried out.

Radar was not precise enough, and as there was concern about the damage coring the structure might cause, it was decided to investigate first from above with a trial hole. As such structures rely on the dead load of fill on top of them an excavation represented a risk of disturbance and movement; consequently scaffolding was set up underneath, instrumented with dial gauges.

Unfortunately the site chosen for the 2m by 1m trial hole was obstructed by concrete and uncharted iron ducts. The concrete was broken out and although vibration could be felt inside the subway the lack of movement on the instruments showed how strong the structure is. The columns supporting it within the subway moved apart laterally by one twenty-thousandth of an inch.

Eventually the structure was revealed including part of one of the octagonal columns. The columns continued higher than the stone rings that appear on top of them from inside the subway. Waterproofing was found to be black pitch. Small patches of pitch were broken away, revealing the joint pattern of the brickwork.

It soon became apparent that the top surface was almost a direct reflection of the fan structure beneath. The masonry surrounding the gas roses was only one brick thick, with a second layer overlain to form a roof with an average thickness of 350mm. They found 'No traces of any other supporting structure'. The findings were to be subject to



analysis by computer programs to determine whether the structure might fail or would need protecting by an overlying bridge.

Consultants were later engaged to examine the subway's retaining walls and report on any proposed interim measures that might be needed. It was determined that the effect of load pressures from traffic was small in magnitude compared to the in situ soil pressures. It was determined that the walls would fail at some time in the future due to the soil pressure.

Various proposals for supporting the walls were considered. These included scaffolding, a raking shore option and a portal frame option. It was recommended that scaffolding be erected to shore up the walls and help prevent future collapse. The scaffolding would require a concrete slab to prop the scaffolding against and due consideration would need to be given to avoiding disturbance or deterioration of the wall – fortunately this never happened. The condition of the subway has continued to be monitored and today that is carried out by Aecom.

Back to the future

The most positive news in recent years is that English Heritage and LBB have jointly commissioned a feasibility study. Aliza Ross, project lead, gave this comment following a meeting on 15 July: "Donald Insall Associates has been appointed by Bromley Council through a heritage grant to undertake feasibility stage works to the Grade II listed Crystal Palace Subway. The impetus for the project is to remove the structure from English Heritage's *Heritage at Risk* list and review the possibility of opening it up to the public once it has been made safe.

"The project has three principal components: survey and investigatory works to establish the overall condition of the structure's fabric and factors that have been accelerating decay; the production of a Conservation Management Plan; and lastly, a costed options appraisal of various remedial work packages, from stabilisation of the structure to a comprehensive repair programme, with recommendations for the best option. It is anticipated the project will be complete by early December 2014."

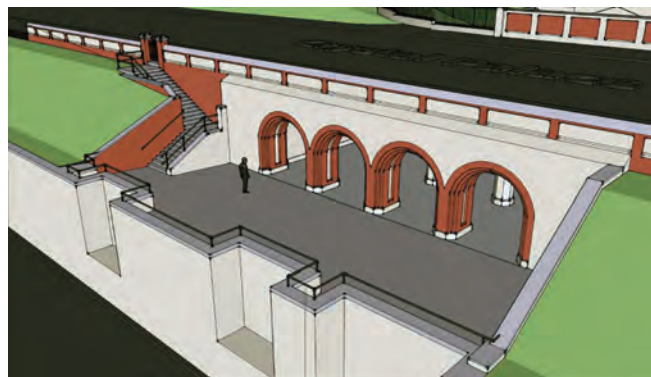
So in 2015, 170 years since the subway first opened, there should be a clear picture of the current state of the subway and the possible solutions for more regular opening. However, as research has shown, the subway has been here many times before with surveys and suggestions but no reopening or reinvented reuse... yet.

4. 2012 to the present day

1. Picking up from where previous generations of subway fans left off the FoCPS have negotiated and worked positively with LBB to secure access two open days to date and in September 2014 the subway will take part in Open House for the second time. This time the weekend will showcase much of the work done by

the IBTS project. There will be an exhibition showing research, photographs and extracts of oral history interviews; as well as an exhibition of young people's artwork carried out during workshops partly conducted in the subway; and newly trained Tour Guides will be on hand to assist visitors to the subway. This year's Open House also coincides with the 60-year anniversary of the closing of the HLS. To mark the occasion Southwark Model Railway Club's model of the HLS will be included in the exhibition and Gary Cross will be running exact models of the two trains involved in the 'last train' events on 18 September 1954.

2. FoCPS have planning approval for a new gate and handrails on the Southwark side of the subway. Southwark's Cleaner Greener Safer programme and the Heritage of London Trust have contributed funding towards this work and at the time of writing the FoCPS are negotiating details of the proposed work before it can commence. The gate will reinstate safe street access to the subway from Crystal Palace Parade using steps on the Southwark side as these are concrete and in good condition. Access from this direction avoids the most hazardous part of the subway, the steps and courtyard on the Bromley side. The range of visitors able to negotiate the steps after the proposed works would be greatly increased, an important aim for FoCPS.



Detail of the planning application submitted to London Borough of Southwark

3. Negotiations for any type of access agreement no matter how temporary have been hindered by the inclusion of parts of the subway in an exclusivity agreement granted to ZhongRong Group and announced in October 2013. However as this agreement ends in February 2015 LBB have become more open to negotiation in recent weeks.

4. Positivity and collaboration have got the FoCPS to the point they are currently, therefore FoCPS are optimistic for the outcomes of the structural survey and for developments towards a formal access agreement. The Friends hope that the significant anniversary at Open House weekend will mark a new phase in the fortunes of the subway.

Footnotes can be downloaded at:

www.subbrit.org.uk/sb-sites/sites/c/crystal_palace_subway/index60.shtml

Visit to Stationary Winding Engine Vaults at Camden

Nick Catford

The London and Birmingham Railway was the first intercity line to be built into London. The first part of the line between Euston and Boxmoor (Hemel Hempstead) opened on 20 July 1837. The Company were restricted, by their Act of Parliament, from running locomotive engines nearer London than Camden so in order to reach Euston a further mile south, the final steeply graded section of line was rope hauled with stationary engines located in a large vaulted chamber beneath the line at the top of the Camden Incline. The winding engines were short lived. From November 1843 some expresses were worked without recourse to the rope, and from 15 July 1844 the rope working ceased permanently and the engine vaults became redundant.

A detailed report on the vaults written by Peter Darley of the Camden Railway Heritage Trust appeared in *Subterranea* 20 (September 2009) so I do not intend to repeat any more of that here.

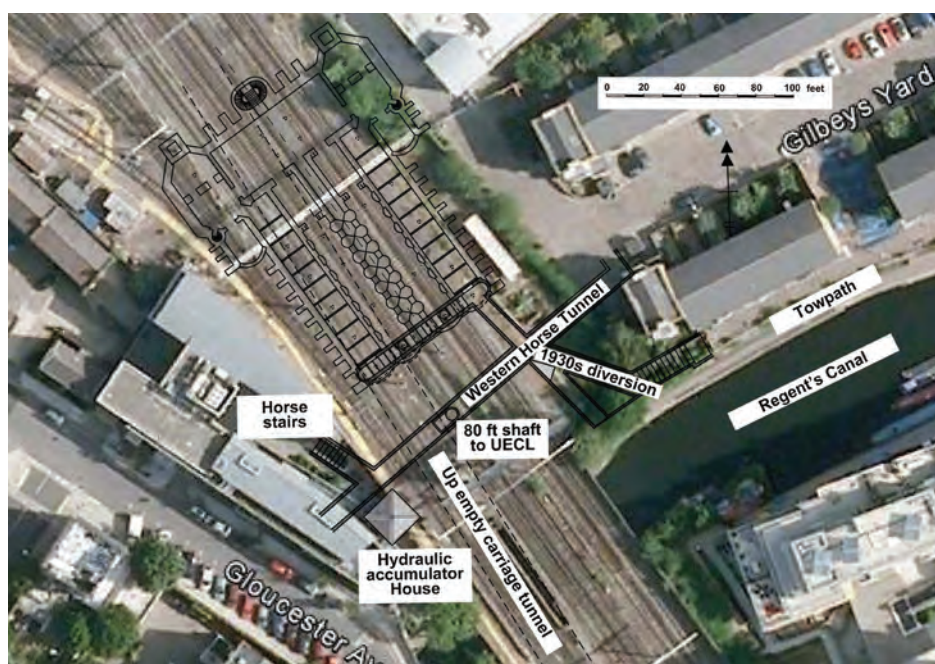
Although now completely stripped of all machinery Robert Stephenson's vaults still exist in surprisingly good condition. The Grade II* listed structure is flooded up to the level of the adjacent Regents Canal and is not accessible. Due to its location beneath the main line into Euston, the water is pumped out once every six years in order to make a detailed inspection of the structure and make any necessary repairs. Once these have been completed the vaults are allowed to fill with water again which normally takes about three months.

The vaults were most recently pumped out in December 2013 and a visit was arranged for 10 December courtesy of Amco Construction Ltd who are the contractors employed to undertake the pumping, maintenance and, if necessary, repairs. Those taking part in the visit were Nick Catford from *Subterranea Britannica*, Peter Darley of

the Camden Railway Heritage Trust and Malcolm Tucker of the Greater London Industrial Archaeology Society. As the visit involved going trackside we were dressed in full orange safety clothing. The purpose of the visit was to record what lies underground so that it can be better appreciated and understood. We were given a thorough introduction/orientation to the site and its hazards by Ken Bagley and were accompanied into the vaults by Ken and his AMCO team.

We entered by climbing down one of the original stone spiral staircases which brought us into the boiler room on the east side of the main line. This is the one section of the vaults that have been damaged, possibly during the construction of the nearby Morrisons store and it is now without its roof. The roof however wasn't original as, when in use, the boiler rooms were open to the air. The roofs were added when the vaults were sealed c1849. Although most of the water had been pumped out there was still some standing water and thick mud which made progress around the vaults difficult once we stepped off the wooden boards that had been laid by the contractor as a safe walkway. We were free to go anywhere and were able to visit and photograph the symmetrical vaults in their entirety. The vaults comprises two boiler rooms, two coal stores, two sheave rooms leading to two rope-tensioning vaults, either side of a central vault with the main engine room at the north end of the vault. We were also able to clamber up a muddy slope at the back of the engine room and climb up an original stone stairway to a grille in the middle of the main line.

After spending a couple of hours underground we were also able to visit the south end of the vaults via the original access tunnel that leads from an unmarked door on the Regents



Canal towpath. This tunnel intersects the western horse tunnel which runs parallel to the canal just south of the vaults. Once in the tunnels we were able to look down through a high level opening into the eastern coal vault. We also looked down a 30 foot laddered shaft to the disused up empty carriage tunnel which runs from an entrance north of the main line between Regents Park Road Bridge and Primrose Hill tunnels and crosses the main line north of the vaults to the west side, emerging just north of Parkway.

My thanks to Simon Bragington of Network Rail for allowing the visit and Ken Bagley and his team for looking after us on the day and to Peter Darley for arranging the visit.

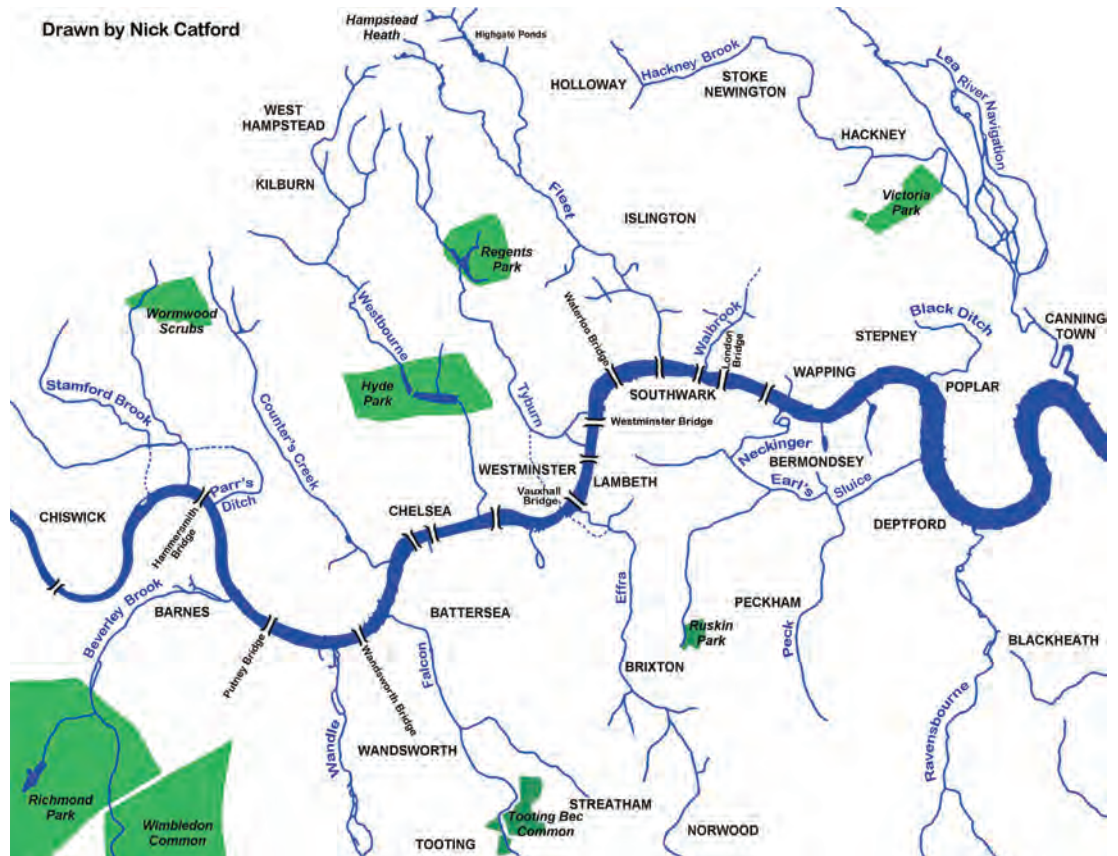
A plan of the engine vaults and access tunnel is overlaid on an aerial view. As can be seen the vault is directly below the full width of the main line out of Euston.



London's Lost Rivers

Tom Bolton

All quests begin with a map, and with the map all doubts begin too. The map in question is from Nicholas Barton's 1962 *Lost Rivers of London*, the seminal river guide. It may seem strange that a 50-year old map is still state-of-the-art in retracing the scores of rivers, streams, brooks, drainage channels and springs obscured by centuries of London's growth. However, no one since Barton has produced a more complete map, and few have even tried. In an era of intense



Based on Nicholas Barton's map, *The Lost Rivers of London*, (New Barnet: Historical Publications, 1962)

focus on London's history and culture, when few overlooked details remain unexplored, photographed and blogged, a surprising level of uncertainty remains about where these rivers run and how they can be found. The Thames within Greater London has around twenty main tributaries, which form the bare bones of its lost river system. Few are entirely buried, but those that can no longer be seen above ground in any form include the Walbrook in the City and the Effra in south London. Others remain visible in some form, although sometimes only after close inspection.

Only the most minimal traces remain at the mouth of the Earl's Sluice at South Dock in Rotherhithe and St Saviour's Creek east of Tower Bridge, the sole remaining evidence of the Neckinger. The two streams that meet to form the Fleet run above ground over Hampstead Heath, forming the Hampstead and Highgate Ponds, originally reservoirs created by damming the flow. The Regent's Park boating lake was created and formed by the Tyburn, as was the Serpentine by the Westbourne. South of the river, the Wandle flows mostly above ground, but is buried beneath Croydon where it once plagued the town with its floodwaters.

Other rivers are happily above ground, too large or too useful to require the treatment meted out to the most central streams. The River Lea was a working river until relatively recently, and now squeezes its way through the Olympic Park. The limelight is not shared by the



Tyburn revealed in building works at Bressenden Place, Victoria in 2012 majority, known only to locals and through the areas to which some give their names.

From east to west, the Thames tributaries flowing predominantly above ground are the Darent, Mardyke, Ingrebourne, Beam or Rom, Roding, Lea, Ravensbourne, Wandle, Beverley Brook, Brent, Crane and Hogsmill, not to mention the artificial Duke of Northumberland's River, which skirts Heathrow Airport. From east to west confirmed tributaries, predominantly buried, are Neckinger, Walbrook, Fleet, Effra, Tyburn, Falcon, Westbourne, Counter's Creek, Stamford Brook, Bollo Brook and Sudbrook.

However, these direct tributaries provide just a fraction



of the full picture. When the tributaries of the tributaries are included, it quickly becomes impossible to fully trace or map the full London river system. They include the relatively well known, such as the Hackney Brook, running into the River Lea but they also include many unnamed streams, and even some false tributaries – streams that must have been entirely man-made.

The system of ditches around Whitehall and Trafalgar Square merits a complex map of its own in Nicholas Barton's book. The dividing line between river and ditch is blurred, and the conjecture involved in producing Barton's map becomes greater the more issues of river attribution are debated. The existence and nature of the Black Ditch in Stepney and Parr's Ditch in Hammersmith are still unresolved.



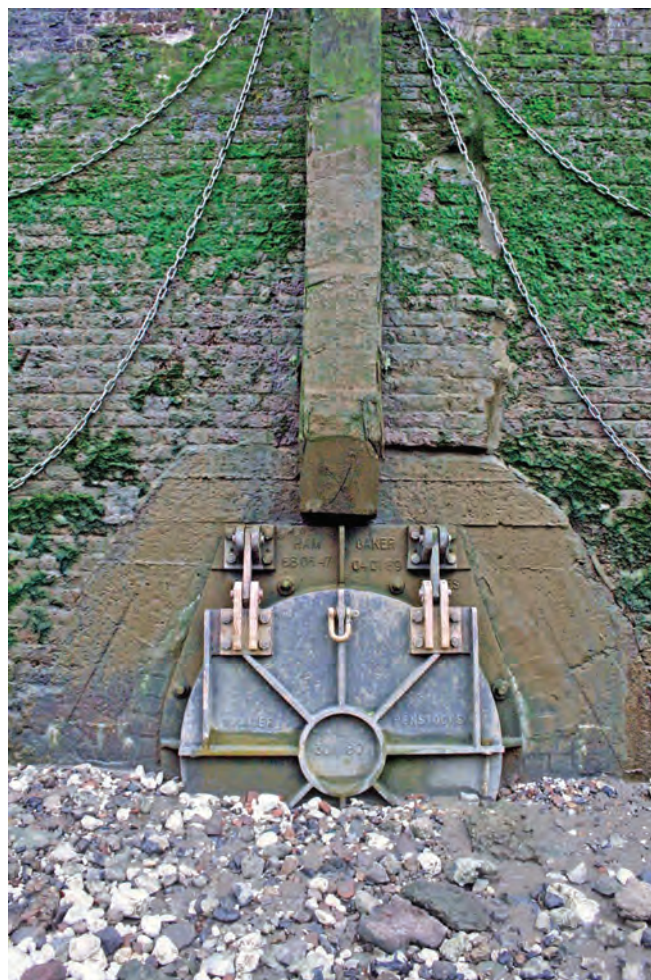
Site of Branch Hill Pond, Hampstead, the source of the Westbourne
 Nicholas Barton was a gentleman amateur whose career as a lawyer lent his local history a precision that has proved invaluable to his successors. However, his map is an involved mixture of conjecture, reconstruction and even fiction. The real problem is that no one was ever able to document London's rivers in their natural state. Nor did they remain the same. The banks of the wide Thames and its marshy flood plain shifted over centuries, and its tributaries moved with it.

The Thames we see today bears little resemblance to the river before the Embankment was built in the 1860s. It is hard to picture a time when tides washed along what is now the Old Kent Road, and Lambeth was largely marshland. Just as the Thames has transformed, many of its tributaries only exist as traces. The centuries have laid a deep drift of archaeological remains over central London's valleys. The City of London's river, the Walbrook, lies in places forty feet below the modern surface level. The steep valley of the Fleet is no longer the ravine that created a natural boundary to the City of London. London's contour map is blunted and smoothed, and the gradients that remain are ghosts of their original selves.

The rivers began to disappear very early on. The Walbrook, which bisects the City of London from north to south, was the heart of Roman London. The City is located here because of the combination of the Thames

and the Walbrook, a smaller, more manageable stream than the tidal estuary. The Walbrook, which passed through the City wall east of Moorgate – which may have given rise to its name – provided drinking water, but also shelter and power. Ships berthed in the mouth of the Walbrook at Dowgate. Much altered, this survives today as the last working wharf in the City of London, where refuse barges beach at low tide and bear waste to landfill in Essex.

However, Dowgate apart, the Walbrook was a stream rather than a navigable river. Its main role was to supply and power early industry – mills, furnaces and workshops were located along the small valley. On Cophthall Avenue just south of London Wall, excavations at Drapers' Gardens in 1967 found evidence of an extensive tannery operation – leather, animal bones, ovens and kilns, even the skull of a bear. Roman civic buildings and villas clustered at the mouth of the river, while the Temple of Mithras, one of the jewels of London archaeology, was found on its banks on Walbrook, the street named after the stream.



Walbrook outfall, Walbrook Wharf, City of London

Despite its place at the very beginnings of modern London, the Walbrook has been largely buried since the 1400s. Our first account of the river comes from John Stow, in his *Survey of London* written in the late 1590s. He is only able to report second-hand accounts of the Walbrook, which by his time had long passed out of living memory. It was apparently almost entirely covered over by the 1460s,



having become much more of a nuisance to the inhabitants of the City than the lifeline it has once been.

The fate of the Walbrook prefigures what was to come for many of London's other rivers. As the population grew



Walbrook Wharf, City of London

along its banks, the river became an open sewer. Choked with rubbish and fed by the latrines that emptied directly into its waters, it rapidly became a serious problem. Attempts were made to control the situation: during the fourteenth century, landlords by the river in Moorfields were legally obliged to clean out the latrines by the river, with the dubious bonus of being able to keep whatever they found. In 1462 those who owned the land on either side of the lower Walbrook at College Hill were ordered to pave it over, and the river dived below ground for the final time.

However, the Walbrook was not entirely gone. John Stow could still describe the Dowgate which, fed by the Walbrook, remained in use as a wharf. In 1574, Stow recorded that a young man who

“during a storme of raine” had tried to vault the Dowgate conduit “was taken with the streame, and carried from thence towards the Thames with such a violence, that no man with staves, or otherwise could save him, by which time he was drowned, and starke dead.”

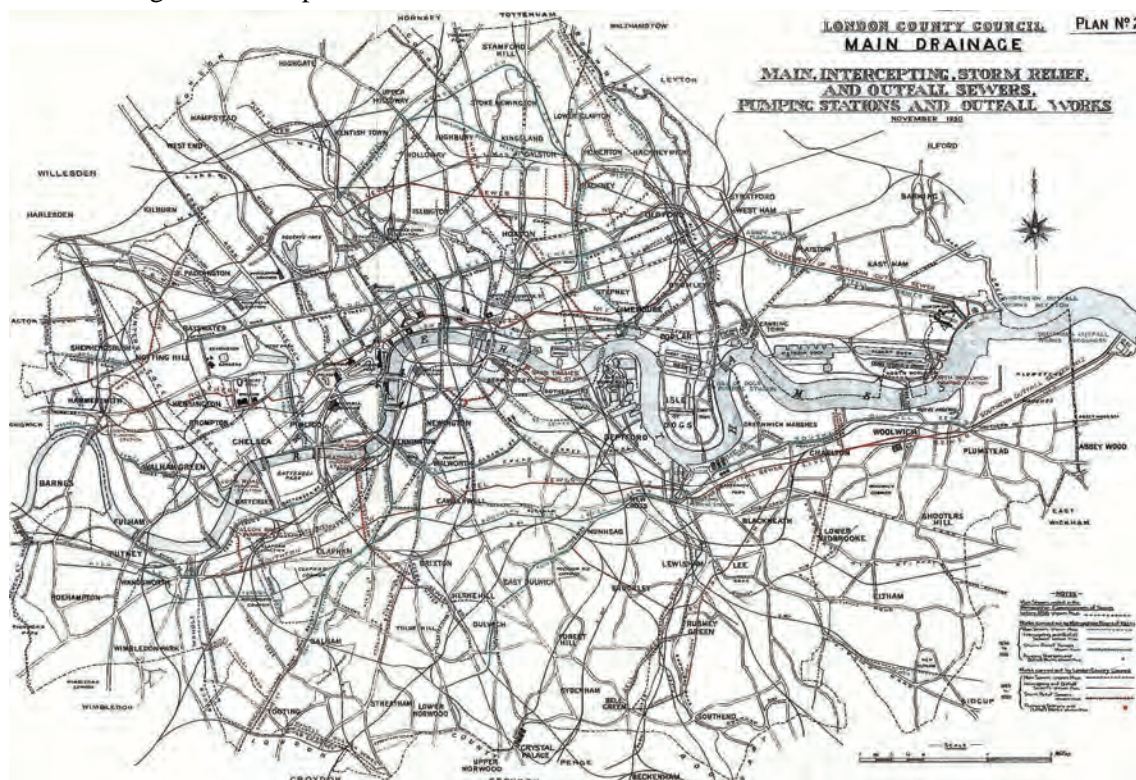
But what of the Walbrook today? Springs do not vanish to order, and rivers insist on flowing whether or not they are wanted. The Walbrook still flows under the City, encased in the sewer system built to deal with the

centuries-old sewage problem, under the direction of Joseph Bazalgette. Out of sight and, for the most part, out of mind, the Walbrook has continued to run beneath the feet of generations of Londoners. So another map has to be considered – the London sewer map.

The edition below, from 1930, contains the current routes of the buried rivers, or at least a version of them. It also contains a great deal else – high level, middle level and low level sewers; outfall sewers; relief and storm sewers; pumping stations; tunnels belonging to the Metropolitan Board of Works and tunnels belonging to the London County Council. It is even more difficult to read than the Barton map, drawn in a time when plans were unrolled and spread out to be consulted on map tables, in rooms built for the purpose.

Reproducing it in a magazine article simply provides a picture of the complexity of London's waste water network, which has only become more so since the 1930s. Fascinating to consult, it can be accessed in full detail at www.sewerhistory.org. However, it does little to help track and understand how the lost rivers relate to the modern London street map.

London's Lost Rivers: A Walker's Guide was written to allow the lost rivers to be tracked on the modern



Sir George W. Humphreys, *Main Drainage of London*, (London, London County Council, November, 1930)

street map, and their routes walked once again. Closer examination of the routes on Barton's map starts to raise questions. Is Barton's route for the River Peck really the only version? What basis is there for placing the source of the Neckinger just south of Waterloo Station? Where is the source of the Walbrook, marked by a tantalising dotted blue line?

One way to resolve such questions is to walk the rivers and trace the topography. The hills and valleys of London

are easily overlooked, particularly in the built-up centre. Because buildings block long views of the landscape, the awareness of the wider lie of the land – which the walker takes for granted in open country – is missing. However, paying close attention to traces of the valleys carved out by the rivers, long before anyone built on their courses, often reveals a great deal of information.



River Fleet, Vale of Health Pond, Hampstead

The most spectacular example of the forgotten river valley in London is the lower Fleet. The name given to the river refers to an inlet, and is found elsewhere appended to place names such as Purfleet or Marfleet. It means, roughly, “river running into the sea”. The Fleet River was named after its inlet, which is now covered by Farringdon

Street and New Bridge Street, linking Holborn Viaduct via Ludgate Circus to the Thames at Blackfriars Bridge. This was a substantial waterway, navigable by large ships and the most significant stretch of natural harbour in London. It became London’s first docks, with wharves spread along its length for unloading goods brought to the capital by ship. Until the Great Fire of 1666, this was where basic supplies to feed and fuel the city were landed – coal, from Newcastle of course, and regional produce such as Welsh cheese. Building materials were also brought to the Fleet wharves, mostly notably the stone used to reinforce the Roman city walls and build the medieval St Paul’s Cathedral, destroyed in the Great Fire.



A drain cover over the Effra, Hermitage Road, SE19

Standing on Holborn Viaduct and looking south, you can visualise the Fleet inlet still there below. The Viaduct,



Possibly London’s most famous sewer intersection. The River Fleet splits at Farringdon Road and the two paths go their separate ways for a bit, rejoining just before reaching the Thames. Photo Adam Slater



Shepherd's Well, source of the Tyburn, Fitzjohn's Avenue, Hampstead

a flamboyant Victorian creation of painted ironwork, pioneering electric street lamps and pseudo-classical statues illustrating progress, is clearly a bridge. It crosses the Fleet valley at a surprising height, revealing that the steepness of its sides has not entirely disappeared.

Thirty feet below the Viaduct, traffic flows towards the Thames along Farringdon Street, following the course of the culverted Fleet. This bridge is the latest of several to have crossed the Fleet at this point, and it remains in place because although the river is gone its effect on the landscape remains.

Christopher Wren saw the Fleet spread out below him too. The Great Fire leapt the Fleet valley, despite desperate attempts to contain the flames. Houses on the west bank of the river were frantically torn down to create a fire-break, tough work that proved futile when the wind carried sparks over the heads of the demolition men into the buildings of Farringdon Without, beyond the City walls. There was complete destruction on both sides of the Fleet, and Wren's rebuilding plans encompassed the river. He planned a more civilised Renaissance London, with grander avenues and boulevards, formal public spaces and an end to the medieval tangle of haphazard alleys. His plans never came to fruition, although his influence on the new London was immense. A place where his vision of a new, classical city did come into being was at the Fleet.

The industrial inlet, dirty and disreputable but very useful, was reborn as a canal. Wide pavements framed a Venetian-style waterway, crossed by new stone bridges at Fleet Lane, Fleet Street and Bridewell as well as at Holborn, designed to allow barge traffic through. This was a more considered version of the Fleet, serving the needs of commerce and of citizens in places designed for the purpose.

Unfortunately, things did not turn out the way Wren had intended. The Fleet, although canalised and tamed in theory, was in practice a very unpleasant watercourse. Before the Fire the playwright Ben Jonson had been one of many London writers to put their feelings about the Fleet into verse, writing a mock-epic poem called "On the Famous Voyage" about a journey along the Fleet to the underworld. He claimed it combined "the filth, stench and noise" of the four rivers of Hades in one, and discussed the turds floating on its water and the ghosts of "farts but late departed".



Tyburn Outfall, Pimlico. Photo by Diamond Geezer

The Fleet was not only an open sewer; it also received tributes from the butchers at Smithfield, where London's meat market was located then as now. The difference is that Smithfield was the centre for live slaughter until the 1800s, and the Fleet received "the heads, entrails, and the hides" of hogs, as well as dogs according to Jonson, who thought that the "hot cooks" who sold greasy meat dishes on the Fleet banks were not too choosy about what they cooked with. To cap it all, the Fleet and Bridewell prisons were located beside the Fleet, and regaled boatmen with "the out-cries of the damned". By Wren's time little had improved, so it is not surprising that his Venetian experiment proved a damp squib. No one wanted to spend time near the Fleet unless they had no choice, and the New Canal, as it was named, was a failure. By the 1730s conditions were so bad that the canal from the bridge at Holborn to the Thames was bricked over, and placed in a tunnel. This became the fate for most of the remaining river, as section by section was covered over. The Regent's Canal, built in the 1810s, crossed the Fleet in Camden and required the river to be placed underground, out of the way. Farringdon Road



Effra Outfall, Vauxhall Bridge. Photo Bermondsey Bill

was constructed in the 1840s, requiring the demolition of many alleys including the famous Field Lane where Dickens' Fagin held court, and the covering of the Fleet. The growth of London meant that the buried rivers were overwhelmed with sewage. The Fleet was described as the 'Cloaca Maxima' of the metropolis, after the original sewer located in Rome. The system for disposing of human waste relied on the night-soil men, who were paid to empty privies at night and remove their contents on their carts. This was a professional service and householders had to pay to have their "soil" removed. Many people were not in a position to do so, and much of London's waste ended up in rivers.

The Fleet received drainage along its course from Hampstead and Highgate, Kentish Town, Camden Town, Somers' Town, parts of Islington, Clerkenwell and Holborn. Walter Thornbury reported in his *Old and New London*, published in 1878, that the total surface area draining into the Fleet in Holborn alone was over 4,000 acres. The crisis of pollution and disease that accompanied the growth of London, as it became during the nineteenth century the largest city the world had ever seen, came to a head with the cholera outbreak of 1849 – in which 14,000 people died – and the Great Stink of 1858.

The summer heat combined with the filthy Thames to create a smell so disgusting, even to the inhabitants of a city used to conditions we would find inconceivable, that Parliament and the Law Courts were nearly evacuated. The following year the Chief Engineer of the Metropolitan Board of Works, Joseph Bazalgette, proposed the construction of a new sewer system under London, and work began that would place those rivers that remained above ground into storm sewer tunnels.

Through the nineteenth-century terraces behind the Gray's Inn Road runs the Metropolitan line. The first underground railway in the world was built partly along the convenient low ground provided by the waters of the Fleet. From King's Cross to Farringdon, the railway was built by culverting the Fleet and laying the new lines on top. Now the combined Circle, Hammersmith and City and Metropolitan lines trains sit below the overground

Thameslink lines, all packed into the Fleet valley, tucked behind houses, creating a shadow space where the river once ran.

During construction of the Metropolitan Railway in 1862, while the river was being placed below ground, it burst from its tunnel and collapsed the excavations, flooding the works between Farringdon and King's Cross. Although the river was a tough opponent, it was successfully suppressed despite all its efforts and channelled into the sewer where it remains today.

The rivers buried under central London are now part of the complex network illustrated on the 1930 sewer map, and their role is to deal with storm water. A trip into the Fleet sewer is very hard to arrange, and a privilege for the few who make it.

The tunnels under Farringdon Street are particularly amenable to exploration. Just south of Holborn Viaduct, the single tunnel that has carried the river from Hampstead opens up into twin, parallel tunnels. This extra capacity is required for the system to deal with the storm water that enters it at a terrifying rate when the heavens open. The Fleet, however, has a powerful flow of its own. The river is definitely alive and kicking, and it is impossible to stand up in the tunnels without weighted boots, as the river's rush would sweep even the biggest men off their feet.

The flow of the Fleet can be appreciated by those observing from street level. Drain covers are the river seeker's friend, and two in particular provide fine views of the living Fleet. On Ray Street, opposite the *Coach and Horses* pub, a round iron grid covers an access shaft. Approach the bars and the sound of water is unmistakable, and so is the smell of the sewer. Peer into the dark and, after a moment to adjust to the gloom, the glint of a stream in full flow, many feet below, is impossible to miss. Equally impressive, another grating at the junction of Saffron Hill and Greville Street offers another Fleet view.



Hampstead No. 1 Pond, the source of the River Fleet

Down in the tunnels, the engineering comes to the fore. Brickwork is finished to the highest quality, the focus of the best construction brains of the era. The Fleet sewer is surprisingly beautiful for a slice of pure function designed to remain unseen; the tunnels have been photographed



with remarkable results. The Fleet is not nearly as unpleasant a place to be as the ‘sewer’ label would suggest. Parts of the system under normal conditions deal only with grey water, from baths, sinks, dishwashers and washing machines rather than the dreaded “night soil”. This does make the tunnel extremely hot, but smells are minimal and rats not in evidence.

Two tunnels run the length of Farringdon Street, one under either carriageway, and then join together under New Bridge Street. A wide, brick-arched chamber opens out to reveal vast twin iron doors, above water level, separating the Fleet from the Thames. When extra water enters the sewer system, the rivers in their storm sewers take the strain. This is when foul water flows in the Fleet, and empties directly into the Thames.

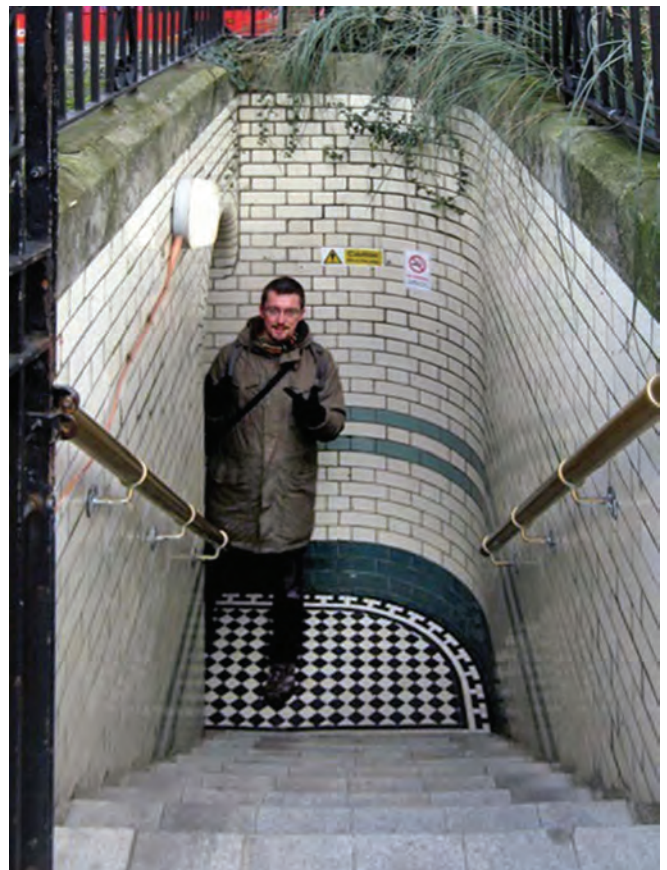
The rivers – the Walbrook in the London Bridge Sewer, the Tyburn in the King’s Scholars Pond Sewer, the Westbourne in the Ranelagh Sewer, and many others – are the weak point of the fêted Bazalgette system. London has struggled to deal with the raw sewage entering the Thames every time it rains hard, but the Thames Tideway super-sewer scheme is designed as the solution.

The project, controversial for the disruption and destruction it will inevitably cause, will lay an entirely new twenty-five kilometre tunnel from Acton in the west to Abbey Mills pumping station in the east. It will hug the Thames from Hammersmith to Limehouse, collecting the waters of the lost rivers all the way along its route. Construction may begin in 2015 and should take eight years. The Tideway will change the lost rivers for good, completing the work begun by Bazalgette by cutting off their direct connection to the Thames.



Tyburn pond, Paddington Recreation Ground

Change is on the way, but it is not game over for the rivers. Interest in their history and future has never been greater. A global trend towards ‘daylighting’ buried rivers has resulted in pioneering projects as far apart as Seoul and Yonkers. In London, significant improvement work has concentrated on rivers that are further from the centre, less comprehensively knitted into ancient urban fabric. The Wandle is above ground again in Wandle Park in Croydon, after forty years under the surface. The Ravensbourne is being removed from concrete culverts near Lewisham station and its tributary, the Quaggy,



The author in search of rivers

has been impressively restored to its natural flood plain in Sutcliffe Park in Kidbrooke. More surprisingly, the Walbrook has been receiving attention.

The Walbrook development, the new Bloomberg Centre on the site of the now-demolished 1950s Legal and General office block on Queen Victoria Street, has dug down to the banks of the buried river where the archaeological finds have kept on coming. The Roman Temple of Mithras will be realigned in the new buildings in its original location, beside the Walbrook. Even the Fleet has featured in proposals for development at the Mount Pleasant Sorting Office, in its valley behind Gray’s Inn Road.

London’s lost rivers have a persistent allure. Their appeal connects back to the original London landscape. Before there were buildings or people in London there were rivers, and they remain as a vital link to pre-history. The oldest elements in the city are its watercourses – mistreated and suppressed, re-routed and hidden, but still there.

The Barton map is an unofficial picture of London, the key to a city not to be found on any conventional street map. Strip away the layers concealing the rivers from us, and the city reveals itself in all its many versions – back to the days when rivers ran above the surface and London was a river city.

Tom Bolton is the author of *London’s Lost Rivers: A Walker’s Guide* (Strange Attractor, 2011) and the forthcoming *The Vanished City: London’s Lost Neighbourhoods* (Strange Attractor, Dec 2014).

All photographs © Tom Bolton unless stated



Czech Mates –
Sub Brit's Prague Study Weekend 9–12 May 2014
Martin Dixon

The last organised Sub Brit excursion to the Czech Republic was in August 1993, when nine members attended an international conference in Prague. Paul Sowan has been enthusiastic about a return visit ever since and when Andrew Smith visited in late 2013 he too added his support. Having had our arms thus twisted, Linda and I set about 'making it happen' with Tony Radstone being the third member of the organising trio.

Coincidences seem to follow Sub Brit around and this weekend was no exception. Like previous European weekends, the date coincided with Eurovision but there was more! In both Liverpool (2012) and Gothenburg (2013) Sub Brit's visits clashed with marathons and the Sunday of our visit continued the theme as there turned

out to be an international marathon in the city of Prague. At least we are used to having to adapt itineraries to ensure that we don't need to cross the racers and crowds to reach our destination. A final coincidence was that just as Sub Brit is celebrating its 40th anniversary in 2014, so is the Prague Metro system.

Liberation and Celebration

For a few of us arriving early on the Thursday, we were able to include a visit to the open day at one of the Metro Depots at Kacerov. Thursday was May 8 – known in Britain as VE Day and to Czechs as Liberation Day and a public holiday. The original opening of the first metro line in Soviet days was arranged to fall on Liberation Day and so we were able to visit the original depot (there are now three) forty years to the day since its formal opening. Our escort for the visit was Ivan Galik – a local underground



A fine line-up of Metro stock at the Kacerov open day. More trains than usual were at the depot as the Metro was on a reduced frequency for the public holiday. Photo by Honza Groh, Wikipedia

enthusiast and professional guide who was to look after the whole group on the Sunday of our visit.

There was something for enthusiasts young and old at the depot: rolling stock galore, practical displays, booksellers, children's games and some catering outlets with local fare. The rolling stock included some maintenance vehicles such as a tunnel cleaner with a circular set of jets and brushes that periodically shine up the running tunnels overnight. We watched a rescue crew demonstrating how to hydraulically lift derailed stock back onto the rails, tried out the emergency breathing apparatus and tried in vain to find any literature with an English text.



The entrance building of the Kacerov Metro Depot is little changed from Soviet days. Photo by Honza Groh, Wikipedia



The tunnel-cleaning machine at the Kacerov Depot.
Photo Martin Dixon

Friday dawned and again those who had arrived in time were able to visit a bonus site. This was the fallout shelter beneath the Hotel Jalta in Wenceslas Square. We had originally



hoped to include the site in the full group's itinerary but attendees were limited to eight at a time so getting 45 people through would have taken up most of the day.

Welcome to the Hotel Jalta – and the Duo

There were perhaps three thousand nuclear fallout shelters in Prague and the one beneath the Hotel Jalta in the centre of Prague was built in 1955. It was constructed when the hotel was rebuilt after World War II, it being one of the victims of the infamous air raid when Prague was bombed, allegedly mistaken for Dresden due to unforecast winds for the night sending many Allied bombers off course.



Listening equipment in the Hotel Jalta bunker. The colour coding on the plan indicated the degree of importance of each guest room. The shelter was extensive and perhaps only a third is currently accessible to visitors. Filter and ventilation equipment is still in place and the main entrance has a decontamination suite. First aid rooms and control posts have been recreated in their original locations.

The shelter would have supported around 150 people for a period of two weeks but was apparently 'off limits' to staff in the hotel above. We were able to crawl along the emergency exit passage which terminated in a vertical shaft (now capped over) and emerged somewhere in the square outside. The most fascinating part of the bunker was kept until last – it had a peacetime role as well as an emergency one.

It held a listening post where the room and telephone conversations of hotel visitors could be monitored. There seemed to be a grading of hotel rooms according to risk or level of interest – the plan of the hotel had rooms coded red, yellow and green. Recording equipment was linked to the phone system and to hidden microphones to ensure that nothing was missed. Bob Clary tells me that he stayed in the Hotel Jalta in his BBC days so perhaps his

conversations at the time are still on record!

We returned to our own hotel – the Duo. This was recommended by Stewart Wild from experience on a previous visit and ideally situated opposite the Strizkov Metro station. It caters mainly for coach parties and was thus well set up for large groups and early departures – of which we had a few. More members arrived at regular intervals – from a range of airports including Heathrow, Gatwick, Stansted, East Midlands, Bristol and Edinburgh. Many of us ate the first night in a local restaurant where the TV was showing the ice-hockey match between the Czech Republic and Slovakia. As you can imagine, the tension was high and when the match was drawn at full time the result was determined by the first to score – a 'golden goal'. Luckily this was scored by the Czech Republic who won 3-2.

Off to Bohemia

Breakfast was taken in the company of hundreds of (mostly) Russian tourists and we met for the first time our host for the day, Petr Olišar. Petr is an active member of the Czech Speleology Society and had responded to our request for members who also had an interest in man-made underground structures. Petr was hugely helpful both in the planning and on the weekend itself and went to great efforts to make arrangements and to prepare information packs for the weekend.

Having collected our packed lunches we rounded up a few stragglers who were combing the coach park asking Russian tourists which was the Sub Brit coach. We were on the road at 0800hrs for the first of three very full days. Our first destination was Decin and to reach it we passed first across the Vltava valley. Next we passed two mining areas – Bidnice which is mined for limestone and Teplice, Usti and Labem which mine brown coal.

We finally ascended the Elbe range and onto the sandstone ridge of Děčínský Sněžník. The roads got narrower and our full-size coach struggled to keep on the road and had to squeeze between and under extensive vegetation. Not for the last time we were grateful to have Petr on board (literally and figuratively!) to persuade the driver to press on.

Decin Fluorite Mine



Remaining mine galleries (grey) and natural caves (orange) that have been intersected during mining



Left to right, our guide Martin, Martin Dixon, Decin Mine Manager Alexander Komashko and our weekend host Petr Olišar. Our first site was the Decin fluorite mine which operated between 1955 and 1994 and contained over twenty kilometres of mine galleries. Fluorite is the mineral form of Calcium Fluoride and is used mainly as a flux in smelting. Other uses include the production of hydrofluoric acid and the manufacture of high-quality lenses, especially for use in the ultraviolet range. A purple form of the mineral, known as Blue John, is well known in the UK, being mined near Castleton in Derbyshire and used for jewellery and ornaments.

During the operation of this mine a number of pseudokarst cavities were discovered underground. Pseudokarst refers to underground cavities found in bedrock that is not soluble – in this case siliceous sandstone. These cavities are coated in almost pure fluorite with an attractive crystal structure. Since 2001 the site has been managed by the Cave Administration of the Czech Republic and we are grateful to them for permitting access to this unique site for Subterranea Britannica.



Underground narrow-gauge junction in the Decin Fluorite Mine. Most of the underground galleries have now been backfilled or blocked but gallery 4 with access to the pseudokarst cavities has been retained. Our guide Alexander Komashko led us down an incline of perhaps 400 metres, still equipped with the original 18-inch-gauge rail track. Not all of the fifteen caves discovered

during mining are still accessible but those that are were stunning. Still lined with crystalline fluorite, they cut across the mine adits looking almost like stopes in Cornish tin mines. But these spaces are entirely natural and formed not by extraction or erosion but by tectonic movement along fault planes.

Along the galleries the rail track continued, with evidence of underground junctions and points – some of them still in working order. Most stunning was a section of brecciated fluorite, mineral which has been fractured and separated and then re-cemented into a new structure. We were allowed to explore the mine at our own pace, clambering along the sides of the large natural caverns as well as being able to visit all the currently accessible mine passages. It formed a perfect start to our group visits for the weekend.



Rare and impressive brecciated (fractured and later re-cemented) fluorite at Decin Mine. Photo Martin Dixon

Janska and its underground secrets

The coach driver having managed to turn his vehicle seemingly on a postage stamp, we slowly returned through the foliage which seemed to have grown even during our visit! Our next stop was still in the area of cretaceous sandstone but at a much lower level in the valley of the Kamenice River. En route to the World War II site we had a slight hiccup as we encountered a railway bridge which was too low for us to pass below. Sending an escort ahead to warn of our diversion, Petr found a level crossing and we approached the site only a few minutes behind schedule.

The complex of textile factories in the Rabštejn valley in the north of the Czech Republic was confiscated by the Germans in WWII and transferred to Weserflugzeugbau Bremen (WFG) whose own factories had been destroyed in Allied bombing raids. The key activities from 1942 onwards were the production of weapons and aircraft. As production stepped up, WFG employed 6,000 workers in the area, made up of forced labour, prisoners-of-war and concentration camp prisoners from eighteen different countries.

By 1944, although the tide was turning, Germany embarked on a programme of moving war production



underground. As a result, concentration camp prisoners excavated around 17,500 square metres of underground space. The original plan was to reach 80,000 square metres. Many prisoners died during the construction and after many years part of the complex is now accessible to tell the story of these dark years; one major output from the site was the Fa223 helicopter. In the Cold War, part of the location was used as a bunker and for fuel storage.



Unlined tunnel in Objekt C showing the weakness of the bedrock. A rockfall is visible in the distance

Objekts of the exercise

We visited three separate underground complexes during our visit, in the original German designations Objekts C, B and H. We started with the smallest network of tunnels – Objekt C. These have a total length of 415 metres, around half reinforced by shotcrete. This shows the lack of natural stability of some of the strata and one of the reasons that the wider complex was never finished. This first network was probably intended for workshops but is believed to have been used as a headquarters and shelter. We had free rein over the network, apart from an area of roof-falls, another indication of the instability of the geology. This area of the complex is opened occasionally by the local community who acquired the site after the end of the Cold War, and a small museum is set up in some of the tunnels, showing relevant artefacts and the history of the location.



High arched tunnel in Objekt B, showing precast concrete reinforcements. The Russian inscription is probably from more recent filming in the complex

Next we moved on by foot to Objekt B. This was a much more extensive network, with larger passages totalling around 1.2km in length. We were able to visit the entire length, which showed us three sorts of tunnel and three different finishes. Furthest from the entrance were rough-cut pilot tunnels, showing the site was due to be much larger when completed.

The bulk of what was built consisted of arched tunnels around four metres in height but some sections (intended for large machinery such as hydraulic presses) were as much as ten metres in height. Around half the tunnel length has concrete arched reinforcement, with 200 metres or so being shotcreted. The remainder is in native sandstone so the visit gave us an interesting view of the geology and construction method as well as the finished product.



View along World War II tunnel, showing the concrete and bitumen supports for the now-removed fuel storage tank

After the end of World War II, Objekt B was empty for a while but the Czech military took it over in 1952 for use as a military store. After the end of the Cold War part of the complex was used as a vegetable store and other parts as a farm for oyster mushrooms. Now it is owned by the local community and we gave our local guide a generous donation to help with their work of preservation.

Fuel for thought

The last location we visited at Janska was Objekt H, around a kilometre distant. This was again built as part of a protected factory but had a fascinating second use. Larger still with over two kilometres of tunnels, the complex had been taken over by the Soviet forces

and used as an underground fuel store. This reuse dates from around 1960 and at that time about 340 additional metres of tunnel were constructed, mainly to provide a connection to the nearby railway at Veselá pod Rabštejnem – coincidentally where we had been held up by the low bridge!

Ten huge fuel tanks were constructed in situ in the former factory tunnels. Most of these have now been removed for recycling but one at least remains. The steel tanks were insulated with asphalt and as well as the railway connection, were able to dispense and take in fuel from a huge compound where we parked the coach. The total capacity of the store was an impressive 7,911,000 litres – a mixture (not literally) of aviation fuels of various grades.



Impressive oil-storage tank still in situ at Janska Objekt H, with Cyrillic script on the butt

We were led through the foundations of removed tanks to one that remained – one of the shorter ones at around sixty metres long. Members were able to explore all around the tank and look inside too. There were traces of insulation, wiring and pipework all along the tunnels but most had been removed since the site was abandoned in 1990. The tank has Cyrillic script on its head but this looks like it may perhaps have been repainted more recently.

Sloup Castle

The final site in our busy day was again in Bohemian sandstone, but far more picturesque and ancient. We drove to the village of Sloup v Čechách where a 33-metre high pinnacle of rock has the so-called Sloup Castle atop it. There is evidence of using the rock for natural protection from the late Stone Age but the earliest record of building on the site is the construction of a watch-tower in the late thirteenth century to protect trade routes. Despite its commanding position, the castle was burned down in 1427 and again in 1639.

In the seventeenth century the by now battle-scarred castle was converted into a hermitage by Ferdinand Hroznata. New rooms were excavated from the rock and a new double staircase was built. The hermitage ceased to function around 1785 and from 1835 the Kinsky dynasty turned the site into a romantic tourist attraction.



The impressive Sloup Castle sits atop a massive sandstone outcrop. The maze of voids beneath the castle is a key part of the site and includes passages, a dungeon, well, chapel, grain silo and religious carvings. We enjoyed a guided tour followed by free time at the site, led by an excellent English-speaker. It is difficult to distinguish the different periods of construction but it (and the nearby bar) made a pleasant end to a fascinating day. The castle is registered for weddings and one of our morning guides (another Martin) was himself married here a couple of years ago. Retracing our morning journey, we returned to the Hotel Duo, where we had arranged a private room for dinner for the group. We gave our thanks and a small gift to Petr who had arranged such a splendid day's exploration and set the foundation for more to come. Czech beer prices have risen in the last few years but are still great value. With another eight o'clock start the sensible members (very few!) retired early.



The Sub Brit group sits enthralled in the Sloup Castle Chapel as our guide points out its features

Underground Prague

Our guide for all of Sunday was the enthusiastic and irrepressible Ivan Galik. Ivan has worked as a walking-tour guide for many years and runs his own company. We'd asked Ivan for a full day and he took us at our word. The detailed itinerary he'd produced started at 0815 and went right through to return to the Strizkov Metro station at 1956hrs precisely. This would leave us four minutes



for the 300-metre walk back to the hotel and to get ready for dinner at 2000! Ivan had worked hard the previous day to factor in the city marathon as the original plan had been done without realising the dates clashed.



The entrance to the Cold War Bunker with briefing by Ivan underway. The area is now an 'official' graffiti zone with the decoration regularly changing

We were to use a variety of types of public transport during the day and we started by catching bus number 136 at 0829hrs to Olanske Namesti, arriving at 0851 (you get an idea about the level of detail that Ivan planned in!). In the nearby park there were two nuclear bunkers – one full of State Telecommunications (dating from 1968) and the other an earlier massive public shelter that was built in 1955. Our visit to the latter began by passing through blast doors and descending a deep spiral staircase. The bunker has a number of parallel current uses and the central space inside the staircase is now a climbing wall.

Bunker mentality

The bunker would have held around 5,000 civilians and was one of around eighty public bunkers in Prague with a capacity of roughly 150,000 people. Some of the shelters would have been converted metro or road tunnels – the former we would see evidence of later in the day. The area at the bottom of the shaft now operates as a music bar; it was good to see the space being used and looked after



Corridor within the bunker, now part of the music bar/night club. The poster is for a local election

rather than deteriorating as in so many similar structures. We passed through to the area that Ivan leases from the city council as a Cold War museum.

Splitting into two groups, we alternated looking at the museum exhibits and the infrastructure of the bunker itself. The former included an immense collection of items both civil and military – posters, propaganda, maps and plans as well as artefacts. These included an immense collection of gas masks of all vintages, pin badges, clothing and even small arms.



Like extras from an episode of Doctor Who, a row of NBC suits keep watch on the Sub Brit party

The bunker itself had rooms where original ventilation plant and filters could be seen along with the rather basic decontamination suite. Ivan and his fellow guide Andrew had an encyclopaedic knowledge of the era of the Cold War and gave us hordes of information with a touch of humour. Collecting handouts as souvenirs of our visit, we headed off to the first of the day's many Metro stations.

The Prague Metro

The first proposal to build an underground railway in Prague was made as early as 1898 by Ladislav Rott. This came to nothing and although further proposals and plans were made from the 1920s onwards, it was not until 1967 that the construction of the system finally started.

What is now Line C was the first constructed and it opened (in part) in May 1974. With Soviet influence, building continued apace with Line A opening in 1978 and Line B in 1985. The lines have been extended outwards since these initial opening dates. There are rail connections between the three lines but these are not used for passenger service.

The three lines of the network are colour-coded on maps and have a total of 57 stations, three of them interchange stations. The network totals 57.4 kilometres and carries around 600 million passengers per year. This makes it the fifth busiest Metro system in Europe – and the highest penetration on a per-capita basis.

The system operates as part of an integrated transport system and interchange with park and ride, commuter trains and trams is excellent. There are plans to add a Line D which would run to the south of the city but although

PRAGUE METRO



Andel Station with artwork from earlier days. In the foreground are ticket barriers which are under trial

of the stations still showed communist design influence but after the end of the Cold War, eleven station names that had a communist element were renamed. For example Leninova station was renamed Dejvicka and the bust of Lenin was removed.

Andel station was opened as Moskevská ('Moscow station') and designed by Soviet architects. It opened on the same day as Prazhskaya station on the Moscow metro – itself designed by Czech architects. Andel still retains some impressive communist-era decoration, both on the surface and at platform level. Most other station platforms are now decorated using coloured aluminium panels. Strizkov station (opposite our hotel) is one of the most recent

additions to the network, having opened in 2008.

Nearly all stations have island platforms but one exception is Vyšehrad, to the south of the centre on line C. The station is immediately after a long bridge across a valley and the two tracks run side by side to minimise the width of the bridge. The bridge is shared with road



The deepest station in Western Europe at Namesti Miru. Photo Mike Proctor

permission for this has been granted, construction is not yet under way.

We started our tour at Flora station and spent the next four hours or so criss-crossing the system and visiting a range of stations with the most interesting features. The city's public transport system is well-integrated and our 24-hour tickets that covered the entire metro, bus, tram and local train network cost just £3.30 each!

Our next stop was the deepest station on the network (and indeed in Western Europe) at 52 metres beneath the surface – Namesti Miru. The distance between platform level and the surface is covered by a single set of escalators whose length is truly impressive. Even though the escalators appear to move much faster than, say, London's, the journey up or down here takes an impressive 2 minutes 21 seconds.

Stations with Political Correctness!

Most of the deeper stations in the centre of the city still have blast doors between the escalators and the platforms. These would have risen into the ceiling to provide nuclear fall-out shelters for the population. Some



Muzeum Station, showing the impressive aluminium platform decoration. Photo Thomas Harvey

The rise and fall of communism in Prague

The Republic of Czechoslovakia was established in 1918 after World War I. The country was invaded by Germany in 1939 and occupied as a German protectorate. At the end of World War II the country was liberated by the Soviet forces and regained its independence under communist Prime Minister Klement Gottwald.

In 1968 after growing local dissatisfaction with the already oppressive regime, the Soviets invaded with five Warsaw Pact armies producing a draconian reduction in civil and political rights. After many years of demonstrations and protests, the communist party resigned in 1989 – a change eventually created without armed conflict or major loss of life and nicknamed the *Velvet Revolution*. The last Soviet forces left Czechoslovakia in 1991 and in 1993, two new countries – the Czech Republic and Slovakia – were created from the former Czechoslovakia.

traffic on a second higher level and was originally designed only to cope with trams. When the plans for the metro system were upgraded to operate normal trains the bridge required expensive strengthening to cope with the increased weight.

During 2002 there were extensive floods in Prague and much of the metro system was inundated. Sadly some of the stations were flooded by water coming along at track-level, rather than from the surface. It appears that no attempt was made to close the blast doors which would almost certainly have halted or at least reduced the levels of flooding. The whole network is again operational but the 'tide marks' can still be seen towards the top of some of the escalator shafts such as at Florence.

Trams and Trains

Our visit to Prague wouldn't have been complete without sampling the city's Tram network and our visit included a short ride between Metro stations. Prague's first horse-drawn tram operated in 1875 with electric operation commencing at the relatively early date of 1891. Today there are 21 routes, operating on over 140km of track. After a short break for lunch, we made our way to Praha Masarykovo nádraží (Prague Masaryk) railway station.

This terminus is located in the New Town area of Prague, near Republic Square and is the first railway station in the city that served steam trains, and the second oldest railway station in the city. The station was designed by Antonin Jungling and came into service in 1845; we had time before our train departed to admire the original booking hall and concourse area. We then boarded a two-decker train for the short ride to the suburb of Bubeneč.

Sewage heaven

From the station of Praha Bubeneč a short walk led us to the late-Victorian masterpiece that is the oldest sewage treatment centre in Prague. It is housed in a palatial building – not unlike the 'cathedral-like' structures at London's Abbey Mills or Crossness. The site is now looked after by a not-for-profit organisation established in 2011 that opens the site to visitors. We were met by two guides for what was to be an enthralling and informative private guided visit.

Bubeneč is an important building and designated as a National Historic Landmark. It was built between the



The impressive building at Bubeneč, showing the twin chimneys. One was a conventional boiler smokestack, the other was used to exhaust foul air

years 1895 and 1906 as part of the Prague sewer network. It was in use until 1967 when a newly-built modern central waste treatment plant (situated on Cisarasky Island) was put into operation. The sewer system and technical design of the old waste water treatment plant were designed by a British civil engineer, William Heerlein Lindley. The building boasts elegant twin chimneys, one used by the large steam engines on site (later replaced by electric pumps) and the other as a ventilation exhaust. Our visit started in the main building where the three main city sewers arrived in a massive collection tank.



The meticulous brickwork of the settlement tanks and linking passages. Photo Linda Dixon

This atmospheric setting was used as the location for the sewers in the 2004 film *Phantom of the Opera*. Within the tank any solids would have been extracted by screening before the liquids were pumped into large settlement tanks. Following the course of the process, we descended into the complex of ten settlement tanks and admired the exquisite brickwork. Each of these tanks measures 87 metres long with a depth of around three metres. We walked along an almost dry overflow sewer and emerged next to the river where the treated effluent would eventually have been released as clean water.



The overflow sewer that we traversed while viewing the underground settlement tanks

Station fun

We retraced our steps to Bubeneč station and most members took advantage of the station's rustic bar which dispensed local beer at less than a pound a pint. When we arrived back at the terminus station, we were surprised and delighted to see a large steam locomotive just getting up steam in readiness for departure from the adjacent platform. The locomotive turned out to be number 464 102, dating from 1940 and still in regular use pulling steam specials.



The fine 1940s steam locomotive getting up steam before its departure. Photo Martin Dixon

Like many cities, the ground level in Prague has gradually risen over the centuries. As a result many rooms that were once on the surface are now deep underground. Our final

visits of the day were to some of these rooms, as well as other vaults and cellars. One of these rather surprisingly now houses an aquarium with the rooms showing evidence of previous doors and windows. Another set of rooms included some fine early mediaeval pillars and archways. It is believed many of the underground cellars were linked during World War II to provide air-raid shelters with assured alternative exits.



Mediaeval pillars still in place in the cellars deep beneath central Prague. Our long and fascinating day was drawing to a close and we retired to another excellent meal in our hotel private room where Ivan had a collection of books and leaflets for us to browse. We gave him our collective thanks for such a splendid day in and around and beneath the Czech capital.

The Kolektory

Our final day started with yet another early start but it turned out to be well worth it! We had arranged a special tour of the city's *Kolektory* (literally 'Collectors' but better translated as 'Service Tunnels'). In order to manage our numbers, we had to split into three groups and as well as the expert guides provided, Petr had arranged for himself and two colleagues, Helena and Catherine, to provide an English translation. We took the Metro from the hotel back to the centre of the city and assembled for a briefing in the main control room of the network.



The unassuming but elegant frontage of the building that houses the high-tech *Kolektory* or service tunnels

The service tunnels route major cables and all manner of pipes beneath the city of Prague. This means that inspections, repairs and upgrades can be achieved without digging up the streets as in most other major cities. As well as reducing maintenance costs, the tunnels also mean that the historic UNESCO World-Heritage-listed centre of Prague can be maintained in an authentic condition. Services carried in this way include water (hot and cold), gas, electricity, phone and data. Although a small network existed earlier, the majority of the network was built in the 1980s and the total length of the system is over ninety kilometres. The tunnels were nearly all excavated from shafts although a small proportion used cut-and-cover; the deepest lie about 35 metres beneath the streets. The whole complex is monitored from a control centre where temperatures, humidity, water levels and pressures and so on are recorded and closed-circuit TV images viewed.



The *Kolektory* Control Centre with screens monitoring everything from temperatures and pressures to CCTV images

Surprise Underground Railway

Each group started with a short safety briefing, video screening and overview of the history of the system. Later groups could see the earlier ones starting their exploration via the closed-circuit TV screens! We were then kitted out in hard hats and descended by lift, emerging in the locomotive depot. Not only were we privileged to explore the network, but we were to be granted a ride on the battery-powered narrow-gauge railway that services the complex. Eight at a time we were loaded – some would say squashed – into the caged passenger carriage and whistled along half a kilometre or so of track to shrieks of enjoyment. We then disembarked and were talked through the various pipes and cables that lined the tunnels. The whole set-up has frequent fire-doors and emergency phones every fifty metres.

There then followed a three-dimensional exploration, using both vertical and inclined ladders up and down in pitches of up to ten metres each. The cables are fed into the basement levels of adjacent buildings through fire-proof seals. The later tunnels (2001) could be distinguished as they had concrete rather than spraycrete linings and the water pipes were in hard plastic. After a fascinating trip, we emerged into the middle of a shopping



Racks carry a myriad of services within the *Kolektory* centre and strolled back to our starting point through the morning tourists and residents.

The remarkable *Kolektory* system is owned and operated by the City of Prague, and we are indebted to the city authorities for recognising our passion and going out of their way to accommodate our visit. It is shame that more cities don't recognise the value of their underground assets and it was refreshing to see that the tunnels were being 'shown off' rather than being hidden and off-limits.



Richard West completes a long vertical pitch within the *Kolektory* tunnels

Kutna Hora Silver Mine and Museum

Returning by Metro, we said farewell to Petr and picked up our coach for the rest of the day. The town of Kutna Hora is about seventy kilometres east of Prague and since

mediaeval days has been an important centre for silver mining. The earliest traces of silver that have been found date back to the tenth century, when Bohemia had already had been at the crossroads of long-distance trade for many centuries. By 1260 German miners began to mine for silver in the mountain region. From the thirteenth to sixteenth centuries the city competed with Prague economically, culturally and politically. In 1995 the city centre was designated a UNESCO World Heritage Site. The mine we visited was discovered in 1967 when a hydro-geological exploration of the town was under way. At a depth of approximately 22 metres an old gallery was discovered. Subsequent exploration showed it to be a perfectly preserved mediaeval drainage gallery, dug from the fourteenth to sixteenth centuries. After a pleasant drive, we arrived in the town and split into two groups. These groups then alternated between visiting the surface museum and the underground galleries.



The massive horse windlass, reconstructed from a nearby mine, at the Kutna Hora silver mine

The surface museum was nothing special but the mine visit was very interesting. We donned hard hats and mediaeval-style mining smocks – we were told the white coats helped people be seen underground in low lighting. After viewing a massive timber-built horse windlass that has been reconstructed from a nearby site we descended thirty metres or so down a metal staircase. This was constructed in 1995 by expanding an original ventilation shaft and provides a second emergency exit and allowed for public opening of the mine.

Once at the bottom we followed the narrow twisting course of the tunnel, with glimpses of the lower-level flooded portions of the mine. The gallery is dug through the Palaeozoic Gneiss of Kutná Hora; quartz and nuggets of Cretaceous conglomerate can be seen in many places in the roof.

Traces of pick marks can be seen on many places on the walls and the roof of the gallery. There are also copious small niches dug out in the walls which miners used for their pit lamps. Around 250 metres of the gallery are accessible to visitors, descending gently downhill above a channel still used for drainage. In winter, between the



Sub Brit members show how their white coats improve visibility deep within the mediaeval silver mine seasons, exploration, mapping and hydrological measuring of other publicly inaccessible areas is carried out.



The narrow twisting passage within the mediaeval drainage adit at Kutna Hora

The Bone Church

Our final site for the weekend was a remarkable sight to behold. In Sedlec, a suburb of Kutna Hora, lies the extraordinary crypt of the Cemetery Church of All Saints. The ossuary is estimated to contain the skeletons of perhaps fifty thousand people, in arrangements that are quite bizarre.

Apparently the Abbot of the Monastery located here visited Jerusalem in 1278 and returned with some soil from Golgotha (the site of Jesus' crucifixion). As a result the church became immensely popular for interments.



The ossuary was created in the fifteenth century but today's arrangements are the result of work in 1870 by a local woodcarver.



A giant chalice of human bones, flanked by columns of skulls

The whole partly-underground crypt is a bizarre and surreal extravaganza of human bones, arranged in montages and sculptures. Piles of human bones in ossuaries are not unusual, with the catacombs of Paris and Rome being firmly established on the tourist circuit; sometimes the piles are even 'artistically' arranged. But this was something quite different. One of our party is a qualified doctor who was able to provide an anatomical commentary of the more complex structures!



A mountain of femurs has been constructed, even incorporating a macabre tunnel

There was everything from coats of arms to candelabra and from pyramids of bones to chains of skulls. As people entered the site you could almost hear a sharp intake of breath and indecision about whether to grimace or grin. Many sites are difficult to recall after years have passed by but I suspect this finale will remain an unforgettable reminder of a great weekend away.

Our coach negotiated the Prague rush hour and arrived at the airport in time to ensure that everyone caught their flights. For most attendees it was the first time they had visited the Czech Republic but for many I am sure it will not be their last!

Photos by Clive Penfold unless stated

And there was light

Members of Subterranea Britannica have, as their primary objective, the study of underground spaces made or used by mankind. Smaller and less clumsy animals than us have had no difficulty in creating or using underground spaces. Worms and moles manage quite well in complete darkness, as do badgers and foxes. But we were less well adapted to tunnelling and using tunnels beyond the reach of daylight before we invented portable artificial light and, of course, tools.

Light other than daylight, moonlight and starlight was known to our prehistoric parents in a number of forms. The living near the poles would have been used to the aurora borealis or australis. Those near marshes would have noticed ignis fatuus (spontaneously ignited marsh

gas or methane) also associated with burials, and in other places glow-worms. None of these light sources were amenable to human adaptation and use. Lightning almost certainly first acquainted man with fire, but it would have been a brave man who dared harvest and use any resulting flames. Tinder (dried leaves and the like) we were told as children could be ignited by the heat released by rubbing dry sticks together, but why anybody should make such an accidental discovery in view of the patience called for is not clear. Igniting tinder by striking iron and flints together could only post-date the smelting of iron which is dependent on fire anyway. At any rate, portable light almost certainly came after the taming of fire but before the invention of the wheel



A return to Alderney, Channel Islands, October 2012

Paul W. Sowan

Groups of ten or a dozen members of Subterranea Britannica have visited Alderney on two occasions, staying at Fort Clonque, a Landmark Trust self-catering establishment in a small Victorian fort with German WWII concrete additions. The first such visit was organised by Robin Ware in February 2002.

A return trip, using the same accommodation, was organised by Brian Hillman in October 2012. Both were 'fringe' visits, organised between collaborating members, not centrally organised or advertised to members as a whole. Fort Clonque accommodates only ten or a dozen persons, and the tiny island (especially 'out of season') might well struggle to provide for forty or so persons forming a group of Study Weekend proportions. Brian, of course, also organised the regular and outstandingly successful Study Weekend visit to Jersey in May 2012.



Fort Clonque – note the causeway which is covered by high tides

Getting to and from Alderney

Reaching and departing from Alderney can be problematic. Ferries operate during the tourist season only. Aurigny, the Channel Islands' airline, operates flights to and from the tiny airport throughout the year, using Trislander 14-seater aeroplanes. There are direct flights from Southampton, and Aurigny flights via Guernsey from Manchester and Stansted.

Both fog and high winds can lead to the cancellation of all flights and, indeed, both the 2002 and the 2012 groups reached the islands about 24 hours later than expected. In 2012 some members spent an entire day getting nowhere at Gatwick, and eventually completed the journey from Stansted the following day. Members flying from Manchester and Southampton ultimately via Guernsey or Jersey and, in one case, a ferry between the two larger islands, also experienced delays. The cost of accommodating stranded passengers overnight in hotels is presumably built into the relatively expensive air fares. Large tidal variations and races and thousands of more or less submerged rocks make marine navigation around the island hazardous for the inexperienced.

Alderney

Alderney is the third largest of the Channel Islands, about three miles long and a mile and a half wide. The Cotentin peninsula of the French coast is clearly visible (weather permitting) a dozen or so miles away to the east. The island is about sixty miles from the English coast, closer than Guernsey and Jersey.

During the World War II German Occupation, the entire native population was evacuated to other islands or to England. It is effectively one large village (St Anne) on a small island, with a population of around 2,400. The 'central business district' of St Anne consists of Victoria Street and High Street, and there is a further accumulation of commercial establishments (including pubs and restaurants) half a mile away down the hill at Bray harbour on the north (English-facing) coast. Much of the open land is windswept tree-less heathland. Rocky headlands are interspersed with sandy beaches.

Much of the south coast is taken up by steep and rugged cliffs where (invasion in force being impracticable) fortifications are sparsely scattered. Around the rest of the coast, one is rarely out of sight of Victorian or German defence works – the former of granite and other hard rock, the latter of reinforced concrete.

The dominant geology of Alderney is crystalline igneous and metamorphic rocks and pre-Cambrian sandstone, so the island is well-endowed with very durable building-stone which was much quarried by the Victorians for harbour and fort construction, and also for export; and by the Germans for aggregate for concrete. Cement for concrete, and lime for mortar, however, had to be imported from France.

Fort Clonque

This quaint 1850s fort is on a very small rocky island linked to the western end of Alderney by a causeway which can disappear under sea-water during especially high tides, in which circumstances getting to and away from the place calls for careful timing.

Access from the causeway is via a single stout gatehouse and door (and a drawbridge). Accommodation for Landmark Trust visitors is in several Victorian casemates, a central building (now equipped also with a large kitchen, sitting room, and two bath / shower rooms), a detached block also with a small kitchen and bathroom in a caponier, and a German concrete gun position, all very tastefully decorated and furnished and centrally heated.

The Victorian-era forts

With such a superfluity of forts on the island, it is not surprising that some are derelict and in practical terms open to exploration by all. Fort Tourgis, overlooking Bray Harbour, is a good example. Outworks on the slope down to the coast harbour an intriguing set of tunnels and underground rooms. Characteristically for Alderney,



access is wide open, and ‘danger keep out signs’ are rarely if ever encountered. There are dodgy false floors, and holes in floors, which anybody of moderate intelligence can recognise and treat with due caution. In Alderney, as in much of western Europe, the British are surprised to find themselves treated as responsible adults!



Fort Tourgis with a German flak (anti-aircraft) emplacement in the foreground on the left. In August 2013 work started to clear access to part of the fort as part of a project aimed at encouraging more tourists to Alderney

Some other forts are in private occupation, or serve as hotels or for other purposes. On our latest visit our local guide and Channel Islands Occupation Society member Trevor Davenport arranged access to another large fort on the harbour edge at Bray, parts of which serve as a storage and works depot for the island’s administration.

The German occupation, forts and other works

German concrete is everywhere! Particularly fruitful for poking about underground is an area high up at the west end of the island where there are the positions occupied by large guns, with subterranean magazines. But perhaps the most rewarding patch is at the eastern end of the island. During the tourist season you can reach it by an adapted London Underground train from Bray Harbour, but as the island is so small it would be no more than a brisk walk from St Anne anyway. The high ground here, overlooking a lighthouse, is dominated by the iconic WWII concrete tower generally known by its nickname ‘the Odeon’, a striking grey building visible from much of the island and helpful as a means of orientating yourself in the unlikely event of getting lost!

Subterranea Britannica visited another of these German range-finding towers on Jersey earlier in the year. Each of the several balconies was to have served as an observation post for one or another gun position, and supplied the gunners with bearings and distances to targets. In fact, as is well known, Britain allowed the Germans to expend vast resources of material, money, and manpower on the fortification and defence of the Channel islands, and made no attempt to retake them. They were liberated some days after the cessation of hostilities on the mainland. Apart from a handful of clandestine landings by small



The naval direction and range-finding tower (Odeon) above Mannez Quarry

groups or individuals (most useful, if at all, for gathering information), the British bypassed the islands for the duration. The Victorian-era fortifications were similarly unused, from a military point of view.

Despite attempts to demolish the Odeon after the war, it remains standing more or less intact, with access possible to all floors. In 2002 the tower was wide open, but access to upper floors was hindered by lumps of concrete in the stairwell resulting from the abortive demolition attempt. These have been removed, but as the tower now houses communications equipment and aerials at the top, access calls for locating a man with a key (not a difficult matter in the Alderney context, where everybody knows everybody! A good starting point would be the excellent museum in St Anne).



Anti-invasion wall around Longis Bay seen from a gun emplacement built into the wall

Another spectacular mass of concrete is a massive reinforced anti-invasion wall backing the beach (a tempting invasion point) at a large bay in the southeast part of the island: the concrete here is in remarkably good condition. At the west end of this wall is a German gun position containing some of its original timber lining and fittings. Usually the relics to be seen are remnants of

electricity and telephone cables, and stencilled German notices on the walls. Adjoining this is an eighteenth-century private house known as The Nunnery, built within what are now recognised to be the modified walls of a small Roman fort, recently excavated. There is no public access to this site, although the Roman walls can be seen from the outside.

German tunnels (Hohlgangsanlage or ‘Ho’)



Entrance to Ho 1 in Mannez Quarry. The unlined tunnel is cut through sandstone and consists of a loop with two entrances, 142 metres in length. It was used to store munitions and rations.



Rails are still in place in Ho 2 in a quarry at the base of Bluestone Hill overlooking The Nunnery. The tunnel was used for munitions storage.

As in the larger islands, the Germans bored tunnelled storage caverns. Whereas those on Guernsey and Jersey are privately occupied, or operated as commercial tourist attractions, those on Alderney have unrestricted access. Indeed, during our 2002 visit local people all seemed to know our group was on the island specifically to get underground as much as possible, the moment we had



Junction of two tunnels in Water Lane Tunnel East (Ho 5) in Alderney. This former fuel storage tunnel and electricity generating station is difficult to negotiate as the floor is up to 18” deep in sludge.





A storage chamber in Ho 5 on the east side of Water Lane. The concrete-lined chamber is clean and dry with 60cm railway track embedded in the floor. The tunnel leading to it is wet and difficult to access. It was cut through soft diorite rock and was timber-propped throughout. The props have all collapsed leaving deep 'sludge' on the floor. For a picture see previous page. The tunnel was used as a fuel store and electricity generating station.

landed: there are few secrets on small islands. Folks leaning on their garden gates, for example, helpfully pointed the way to the best entrance to the Water Lane tunnels!

The easiest tunnel to find, and the pleasantest to visit, starts at the foot of a small cliff in the quarry below the 'Odeon', close to a spectacularly large and rusting rail-mounted machine crane abandoned close to the heritage railway's eastern terminus (the location is Mannez Quarry). The curved tunnel is wide open, dry and airy; its far end, however, opening back out into the former quarry, is almost blocked by fallen stone.



At Lager Sylt the access to the Camp Commandant's house, which was outside the main compound overlooking the sea, was through this short tunnel from the washroom and coal store.

The second-pleasantest tunnel is at the foot of a small quarry face on the St Anne side of The Nunnery. There is an engaging bit of whimsy a short way inside on the left. It is possible, by traversing mud and a puddle, to emerge at the far end, and walk back to the start along a footpath.

There are two further tunnels either side of Water Lane, in a small wooded valley running down from St Anne. These, although both open, call for considerably more care underground, as there is loose and unsound rock overhead, and in places deep mud and water on the floors. Remnants of branch tunnels, side storage chambers, light-rail track and a turntable can be found, and a lot of rotten prop timber. The left-hand tunnel, facing up the valley, is the least dodgy!

The Sylt concentration camp

There were four forced-labour camps on the island during the occupation, of which few visible traces remain. Tracks around the west end of the airport runway lead to the site of the most readily identifiable, called Sylt (the camps were all named after German islands). Not much

more than the gate-posts can be identified, but assiduous searching in the overgrown thorn bushes nearby may lead to the discovery of a very short former tunnelled access to the Commandant's house.

The Museum

When open, the small but impressively good museum in St Anne is strongly recommended for a rounded and comprehensive overview of this fascinating island. And indeed as a point of contact for people who might be willing to turn out with keys to the few locked sites of interest.

Conclusions

Alderney is a small friendly island, littered with eminently explorable defence features from small-scale to enormous, most of which have effectively unrestricted access. Although most place names and many personal names look very French, I never heard a word of French spoken.

All the Channel Islands seem more British, if possible, than the British. They are neither UK nor British, but owe allegiance to the British Crown. Currency is sterling, and you may encounter Jersey and Guernsey pound notes and coins, which are not easily accepted back in the UK. But British coins and notes are welcome in the islands! At check-in at the airport, you are addressed by your first name. The beer is drinkable! Not a bad place for any Sub Brit member interested in military matters and underground spaces to consider for a do-it-yourself exploration holiday.

All Photos Nick Catford February 2002



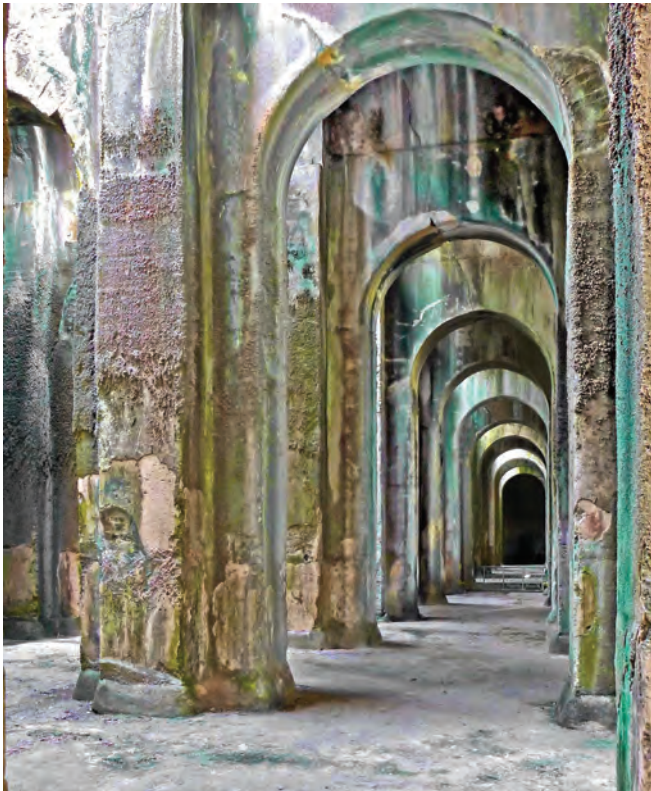
Ancient Mysteries under Naples

Julian Allason

“There is more of Naples underground than above the surface,” asserts my local friend Mimmo. Catacombs, ancient temples, buried streets – and now a new metro line – all lie beneath the picturesque city of baroque churches and palaces. Napoli is old, with settlements that have ringed the lovely bay for three thousand years. Some underground sites are well publicised with excellent tours guided by the experts of Napoli Sotterranea. Others are less well-known, a few remaining the secret venue of nefarious activities. Illicit distilleries, Aladdin’s caves of stolen treasures, and even what the *carabinieri* suspected was an interrogation chamber used by the Neapolitan mafia, the Camorra, have been uncovered. Hidden passages are occasionally reported to have been used by the ‘men of honour’ as escape routes to evade arrest or *sterminio* by rival crime families.

Water for the fleet

Our first expedition is to La Piscina Mirabile at Miseno, high above the Roman naval fortress of Serino that guarded the northern approaches to the bay. Here the Roman fleet assembled for the invasion of Egypt and the Levant. The perennial problem was water. Hence the excavation on the orders of the Emperor Augustus of a massive cistern fed by natural springs. The 15m-high barrel vault is supported by 48 pillars cut from the tufa rock to create naves that give it the appearance of an underground cathedral (not unlike the rock-cut churches of Lalibela in Ethiopia).



The cistern was excavated leaving tufa pillars lined with opus caementicium to support a massive barrel vault

At 70m long by 25m wide the tank is second only to the Basilica cistern in Constantinople (today’s Istanbul), capacious enough, or so the Byzantine emperor claimed, to float a war galley (Sean Connery used a rowing boat in the Istanbul cistern during the filming of *From Russia with Love*). Both cisterns seem to have been closely guarded to prevent poisoning of the water source. Even today La Piscina Mirabile remains little known and most Neapolitans, while expert on pizza, opera and politics, continue in ignorance of the massive and almost perfectly preserved Roman structure on their doorsteps.

The interior, capable of storing 12,600 cubic metres, was lined with waterproof concrete similar to that used in the construction of the Pantheon temple in Rome (now somewhat surprisingly a Catholic church). The floor slopes downward to a decantation pool and a sump used for periodic cleaning.

There is disagreement as to the method of extraction employed. One theory posits that the stored water was pumped up to a header tank on the roof – this however seems unnecessarily laborious. Recent archaeological study by the University suggests that the fleet was watered using a gravity-feed system through an aqueduct running down the cliff from the cistern to the sheltered dock below. This may have had floating pontoons to which several galleys could tie up simultaneously. The operation could thus be carried out expeditiously.

Grease eases entry

The cistern is, like much else in the Mezzogiorno, theoretically closed but access can usually be arranged by someone with local connections with an appropriate



Unusually the most ancient remains including the Temple of Apollo are at the top, the most recent including the Paleo-Roman burial chambers are at the lowest level

sum for “refreshment” of the facilitating officials. Academic interest is an acceptable pretext.

Just up the coast is Cumae, the furthest point north that the ancient Greeks colonised and to which they brought the mysterious Eubolic script, precursor of the Latin alphabet. The necropolis here dates to 730 BC. But it is from the Roman period that the area’s notoriety derives, for this was the location of the Cumaean Sibyl, an influential oracle at the sanctuary of Apollo, who “sang the fates” and served as a guide to the underworld.

As we make our way through the pentagonal tunnel, a chill descends as we penetrate the heart of Mount Grillo. At the terminus is a vestibule where, according to contemporary accounts, petitioners of the Oracle were relieved of their offerings before being admitted to her presence, though carefully kept at a distance behind a veil.

What does she mean?

Unlike Delphi, where the Sibyl’s trance has been attributed to volcanic gases, narcotics were the likely medium here according to the historian James McDonough, an authority on the area to which his company Art Tours Ltd arranges special trips. It was, he reckons, an accomplished shake-down operation, the prophetic verses produced being sufficiently ambiguous to admit of multiple interpretation, and scandalous enough to promote the myth.

An appropriate veil of mystery and confusion surrounds the purpose of other tunnels here, which show evidence of military and quasi-religious use at different periods over two millennia. Some were even employed as catacombs during the Paleo-Christian era according to the official record of the Superintendent of Archeology.



The pentagonal tunnel (illuminated by later adits) leads to the chamber of the Cumaean Sibyl

A modern coven of neo-pagans who attempted an orgy on the site are said to have suffered a troubling infestation of scorpions and subsequent affliction by the evil eye. As a subterranean experience, then, Cumae has everything: tunnels, caves in which unspeakable rites were performed, hidden passages and burial vaults. Only a nuclear bunker is missing. As Dr McDonough remarks, “It was gothic before gothic was invented.”

Returning to Naples through Pozzuoli we are unable to resist the Solfatara, the Portal to the Underworld favoured by the Sibyl, in reality a semi-active volcanic crater half a mile in diameter permeated by vile-smelling gases. Sulphurous pools bubble ominously and several areas are cordoned-off following the disappearance of the inebriated or unwary.



Entrance to hell

“A most direct route to Hades,” Mimmo observes. In several places jets of steam vent into the clear blue sky. Close to one an improbably amorous couple on a wooden seat hurriedly adjust their clothing at our approach. But then the gases are promoted as “natural Viagra” and the high local birth rate would seem to support this. At a stall outside the entrance a vendor is doing a steady business in fertility symbols and bars of evil-scented “Underworld Soap”.

So far so exotic, but, this being Naples, worse is to come. At the heart of the old city, though not on every map, is the largely eighteenth-century Capella Sansevero, named not for a saint but for a debauched prince with a penchant for alchemy and donkeys.

Part Christian chapel, part masonic temple, and wholly devoted to the glory of himself, this parody of a church was constructed by the Prince Sansevero because he could afford to indulge his obsessions, apparently with no expense spared. Yet it possesses several outstanding works of art, notably Giuseppe Sanmartino’s sublime statue of *The Veiled Christ* in which the Saviour’s burial shroud is rendered almost transparently in marble. The prince was nonetheless excommunicated by the Pope. And a second time for good measure.

In the crypt beneath is an exercise in the macabre taking the form of two “anatomical machines”. A couple of the prince’s servants were induced to leave their bodies to him for alchemical experiment. He is believed to have had injected (though the method is disputed) into their veins an alloy of lead, leaving, after putrefaction, only skeletal, venous and ventricle systems. The female servant was pregnant causing one to wonder about the manner of her death: in a sinister recent development the remains of the foetus were stolen for, Neapolitans are convinced, satanic ritual purposes.

The thieves had better watch out. For, when I commented

on the smart new ticket office that has appeared opposite the Capella, Mimmo quietly confided that the property had recently been acquired by the Camorra, “as an investment”.

Information

Recommended English-speaking accommodation:
Donna Regina B&B, Via Luigi Settembrini 80, Naples.
info@discovernaples.net

Unusual guided visits to Naples with special access:

Art Tours Ltd www.arttoursltd.com

Underground city tours: Napoli Sotterranea
www.napolisotterranea.org

Photos by Julian Allason

Lundy Island, Devon

Lundy (it means Puffin Island) is a National Trust property (since 1969) 11 miles northwest of Hartland Point on the Devonshire coast. It is about a mile and a half long, and half a mile wide. An undated ‘Official Guide’ mentions, inter alia, old copper mines, Queen Mab’s Grotto, several quarries, Benson’s Cave, and the Devil’s lime kiln.

Most of the ‘caves’ are entirely natural rift caves or wave-eroded sea caves, and thus outside the scope of Subterranea Britannica’s interests. A few, however, have been used and in some cases even made by human beings. Listed anti-clockwise from the landing jetty at the south-east extremity of the island, Watson’s survey includes data for the following man-made or man-used ‘caves’.

The Old Man’s (or Sentinal’s) Cave is 38 metres long, and recorded as having been used for storage after a shipwreck in 1867.

A ‘Landing Quay Cave’ is 9.5 metres long and described as ‘possibly man-made’ and has also been used for storage.

North of Gull Rock (just over halfway up the east coast) an adit referred to as Tibbett’s Point Mine, accessed from a cliff ledge, and stated to have a length of 61 feet (18.76 metres). A survey (plan and sections) made by members of the Shepton Mallet Caving Club in 1969 accompanies this short entry. It seems likely that this ‘mine’ in an awkward location cost more to drive than the value of any ore that might have been extracted from it!

Queen Mab’s Grotto, a sea cave near the Frenchman’s Landing a little further north, is 7.5 metres long, and said to have been used as an ammunition store for the Brazen Ward Battery: this seems improbable for a sea cave which, although now above beach level, seems hardly likely to have been reliably dry enough for the purpose.

Two ‘underground rooms’ reportedly exist at low level in the cliffs near North End Point, but were not located by Watson.

Old copper mines are reported at Long Ruse (or Long Roost) near the northwestern extremity of Lundy. These comprise three parallel adits just above the high water mark, with lengths of 3.6 metres, 12 metres, and 15 metres. Watson notes that ‘the copper samples were poor and the mines abandoned’.

The ‘Devil’s Limekiln’ (near the southwest corner of the island) appears to be a natural rather than an industrial feature. As there is no limestone on the island, any limeburning would have relied on stone and fuel imported from the mainland, and located at a much more accessible place than the cliff face!

Benjamin’s Chair Mines, halfway along the southern coast, comprises two adits, 10 metres and 23 metres long. Remains of timber supports are noted. About 12 metres higher up the cliff is another adit, a metre wide and two metres high, driven in for about six metres. This trial mine was probably as unproductive as the other two.

Benson’s Cave, near the southeast of Lundy, is just below the ‘castle’ and 300 feet above sea level, so not a sea cave. Watson reports this to have been excavated in ‘friable shale’ in or about 1700, perhaps by smugglers. The 20-metre-long tunnel is uniformly 2.5 metres wide, and 3.5 metres high, and has a built stone lintel over its portal. Nearby a small brick hut has been built into the hillside. The smuggling interpretation is perhaps far-fetched. Importation of smuggled luxury goods from France onto the British mainland seems to make economic sense. But what might be smuggled in from the next nearest coast, of South Wales, and what duty-free sales might have been made to the tiny population of Lundy (population 94 in 1901) amongst which one supposes few secrets would exist! The excavation of 175 cubic metres of rock for such a clandestine purpose seems disproportionate to say the least!

SOURCE: WATSON, A., 2013, An update on the caves, mines and other underground items of interest on Lundy Island. *Newsl. Chelsea Speleological Society* 55(9/10), 67 – 88 [including plans, sections, photographs, a map of the island, and a list of historical sources]



Basement Shelters

Chris Rayner

During the Second World War many basements and cellars were adapted for use as air-raid shelters, but surviving traces of such use are rare on the ground (or rather, under it). Word-of-mouth information can be invaluable, as when a former tenant of a Regent Street shop made contact about a surviving shelter having just read Nick Catford's book *Secret Underground London*. Simon Carter had previously been a tenant in Quadrant Arcade, which was created in the late 1880s rebuilding of architect John Nash's circus in Regent Street to the north of Piccadilly. He recalled the shop's basement having a wartime steel-faced blast door and timber props, and that there were also blast subdivision walls, chemical toilet recesses and ARP signage.



Wartime timber strutting under Quadrant Arcade miraculously surviving through seven decades of refurbishment. Four stanchions formed of doubled up timber boards resting on large timber wedges bolster up a small section of arcade floor. Photo Nick Catford

Originally he had thought the props were to support heavy safes on the floor above from a time when the shop had been used as a jewellery store, but then he had found in his lease documentation records of emergency works in 1940, including an approval for a basement shelter.

Personal visit

Major regeneration works are currently under way in this part of Regent Street and it was hoped that we could take a look beforehand to see what remained. Crown Estates kindly allowed a visit and their contractor SISK's foreman showed us around the basement level. Small compartmented cellars under the arcade shops are connected to a passage running the length of the arcade from Regent Street to Glasshouse Street. The passage walls have been refaced with neatly painted blockwork, but the timber props are surprisingly still there, fragments of the 1940s surviving in a 21st-century basement.

The timber props and beams are made up of pairs of planks bolted together to act as single larger dimension struts, perhaps an attempt to make do with a limited range of timber section sizes at the time the work was carried out. Smaller sections are also easier to manoeuvre in confined

spaces and are lighter. Beams and posts are linked by diagonal metal straps called "timber dogs", their purpose being to locate the pieces together. These support a rough arrangement of planks of the same section presumably to bolster or shore up ceiling sections below the arcade that were felt to be weaker than others (or perhaps which had deflected when the nearby Regent Palace Hotel was hit by a high-explosive bomb in October 1940).

The props rest on thick tightly cut wedges which would have been hammered into position. The absence of steel, the roughness of the timbers and the irregular spacing of the ceiling planks all speak of haste, but the work is good quality. The likelihood is that the works were quickly carried out at some stage during the first phase of the Blitz (September – November 1940), and the more ad hoc nature of the strengthening works suggests that they may have been private shelters for shopholders and their customers.



Timber framing in the Room 62A of the Cabinet War Rooms possibly installed as part of the late 1940s strengthening works when a reinforced concrete slab was inserted above the bunker in the New Public Offices' sub-basement. The large square posts rest on spreader wedges and support tripled up bolted joists, on this occasion diagonally braced to resist lateral ground shock movement. Photo from Cabinet War Rooms

The timber propping seen in part of the Cabinet War Rooms in Whitehall half a mile away was added to supplement the original steel framing of the building in the wider-span war rooms. It appears more elaborate and struts are braced which would give greater resistance to lateral movement caused by underground detonations. All the same, this sturdier construction did not deter subsequent builders from taking liberties.

Basements were widely used as air-raid shelters during WWII since, being below ground level, they were protected to a degree from lateral blast, and where they were without windows they could also be more easily protected from gas. Potential disadvantages, though, included being crushed by the building above if it collapsed, being trapped, burnt alive, drowned or suffocated, though not necessarily all at the same time.



Government advice

The first official guidance on basement strengthening was published in 1937, but the 1939 Civil Defence Act paved the way for a great many more basement shelters. Local authorities were given new powers to designate private basements in houses or commercial premises as public shelters irrespective of the owners' wishes; meanwhile poorer householders with cellars would be offered a free steel strutting kit as an alternative to having an Anderson shelter.

The strutting was intended to strengthen the underside of the ground floor level forming the shelter's roof, and the domestic strengthening kit included corrugated steel sheets to bolster up the floor above and steel joists and posts in various lengths. Clipped connections between steel members (rather than bolted or welded connections) were used to allow the authorities to collect the materials once the risk of bombing had been eliminated.

The posts had adjustable feet to cater for height variations, but they did need concrete pads to be excavated and poured unless the floor was particularly hard. A surviving row of tubular steel posts supporting precast concrete ceiling planks in a Middlesbrough basement public shelter seems to have been used in a similar way to overcome a vulnerable point.



In the reused cellar of a Manchester city centre shop, some simple shelter rules greet arrivals at the base of its wartime external stairs. Steel structural reinforcement, added to withstand the load of the collapsing building above, survives beyond

Cities outside London

A more complete example of steel strutting is under a Manchester city-centre shop. Access today is via an incongruous covered stairway in the middle of the store's street frontage, for this was used as a public shelter. As you descend the steps from street level, a stencilled **No Smoking - Air Raid Shelter** greets one, and other signage includes a cheery **Urinal Buckets** and a small brick panel stencilled **Emergency Exit** with the hand-painted postscript **Break through this brickwork with emergency tool** below it. The wartime steel frame supports a layer of corrugated steel which also gave incendiary protection, but the survival is unusual. It is as though the City Corporation forgot to reclaim them.



Rouse's is the largest known sand mine in Nottingham, worked from at least 1780 onwards. Together with 75 other former mines in the city it was designated as an air raid shelter in WWII and fitted out with steel strutting and blast walls particularly near its new Peel Street entrance

Often propping was kept to vulnerable points. Surviving propping in Rouse's sand mine in Nottingham is restricted to a short section near the entrance. Again, sections are bolted together rather than welded to aid postwar demountability and support corrugated sheeting, probably in this case to keep dust and rock fragments from falling onto shelterers. Another shelter under a nearby Nottingham pub has sloping ceilings of corrugated steel as though it was in an attic, a modification required to fit under the late-medieval sandstone cellar's vaulted roof.



Many of Nottingham's pubs had medieval and later rock-cut cellars (one described as a cock-pit!) which were ideal for use as shelters for the owners and customers with a little adaptation

In Liverpool, the Cunard building's basement was used as the city's central ARP headquarters, and the importance of the site led to a supplementary grid of massive steel framing being added to give added protection to the building's reinforced concrete frame. Another Liverpool site under a city-centre office building retains its brick subdivision walls with strange diamond-shaped plated escape hatches between chambers, a modification possibly intended to avoid the need for a lintel.

Not all basements needed strutting. A very large shelter under a block of flats in Ladywell, Birmingham, included compartmentation to reduce the effects of a direct hit, and also escape tunnels. Alternative escape routes were a feature already present at the Co-op headquarters in Manchester

when tunnels built a decade before to link together their buildings on adjacent plots were used to provide alternative escape routes from their basement shelters.



Built during the First World War, the Cunard building in Liverpool had, for its time, a cutting-edge reinforced concrete frame. Framed buildings were considered to withstand bombing well but as the lowest of its two basement levels was to be used as both the city's ARP headquarters and a public shelter, a supplementary grid of steel framing was added just to make sure. First Aid Posts were required in all large shelters following Horder Committee criticisms and new Ministry of Health guidelines at the end of 1940

Domestic shelters

The Home Office basement shelter guidance stated that there needed to be an escape route either into adjoining basements or via tunnels to the exterior of the building. Where cellars adjoined those of neighbours, the Council's strutting installation contractors would knock escape holes (which were then rebuilt but with a much weaker mortar mix) from cellar to cellar in a row of houses.

If there was no other option, an existing coal hole might suffice as a basic escape hatch; however the official guides recommended using buried concrete or metal tubes to take the occupants at least 9 ft clear of the external wall of the building. This was often ignored because of the additional work involved, and usually the identifiable cellar escape hatches seen today are close up against the wall and often have a distinct local design, such as the stone box-like structures seen on the front walls of many houses in Huddersfield.

Basement shelters have rarely survived intact, and often they can only be identified from small pieces of evidence. Wartime shelter posters and graffiti, because they do not obstruct the usable storage space, can survive where other traces are lost. A large public shelter under shops in the centre of Middlesbrough was formed by connecting adjacent cellars which were after the war re-separated, but some faded **Shelter Rules** and public information posters (**Where there's Dirt there's Danger**) remain on its walls. A lot of thought went into many of the basement shelter proposals. Boots the Chemist was a business that took its responsibilities seriously and used its in-house architects to draw up proposals for ARP retrofitting of all their shops and offices around the country, all now thankfully archived. Drawings of one of their shops in Llanelli,



In central Middlesbrough a very large public shelter was formed by joining together a number of shop basements. Although later re-separated, traces remain of its wartime use in signage and localised strengthening with wartime steel struts

for example, show a small corner of their basement unpacking room redefined as a "Refuge Portion" with single "gas blanket" separation in 75mm x 50mm "sloping jambs". An emergency escape tunnel is shown with 150mm reinforced concrete protection above it as it runs out to a vertical ladder shaft and a final, slightly incongruous timber exit door. The drawing is dated 16 August 1940, and one can imagine a new urgency in the drawing office as they heard reports of the fierce fighting of the Battle of Britain in southern England.



The well-meaning owners of this Leeds factory provided a comfortable and well-appointed shelter for their staff but without basic ARP protection this could have been a death-trap like many other factory basement shelters

But how well did all these precautions work? Government research teams found that small basements performed very well under bombing, and ironically it was even found that the steel strutting was unnecessary due to the way houses collapsed and the loads involved.

Unfortunately this was not the case with larger basements under older (non-steel framed) shops, offices and factories, which in many cases were potential or actual death-traps, usually due to shortcomings in the ARP design. A staff shelter under a factory in Leeds, for example, has elegant signage but its glass doors, flimsy compartmentation and unprotected perimeter light-wells could easily have been disastrous.

All photos by Chris Rayner unless stated



The Lapal Canal Restoration Project

Dr Peter Best

Dr Peter Best, Chairman of the Lapal Canal Trust, explains how the Lapal Tunnel might be replaced with a Diagonal Lock to recover the former Dudley No 2 or 'Brummagem by-pass' Canal.

Additional notes from Lapal Canal Project web site www.lapal.org



In their earliest years, canals were typically operated by their originating company with minimum forms of cooperation and mutual assistance between companies, even at the junctions of their canals. Thus there was often a level of contention and conflict between vessels on short-haul journeys and those on long-haul missions. In heavily congested sections of the gradually emerging canal network, these conflicts became increasingly unacceptable to the initiating shareholders who (as ever) wanted an optimum return on their investment. Let us now consider the case in point.

The northwest segment of the West Midlands plateau (underneath Dudley and district), being significantly older than the segment beneath modern Birmingham and district, had abundant reserves of high-quality coal. This was the principal fuel for almost every industrial process and was in high demand for steel and the industries which gave the district its alternative (yet affectionate) designation of 'The Black Country'.

Background

The city of Birmingham and its neighbouring towns of Dudley and Wolverhampton, in the West Midlands conurbation, share the almost unique property of not having developed out of primitive river crossings. Instead, they all sit on a large elevated plateau of land between two substantial rivers, the Avon and the Severn, into which flow a few brook-sized land drains, notably the Cole, Rea, Stour and Thame.

One of the several simple consequences of this geographical oddity is that, prior to the Industrial Revolution, these West Midlands settlements were little more than isolated villages or hamlets with only very simple levels of trade and transport between them – typically in horse-and-cart loads.

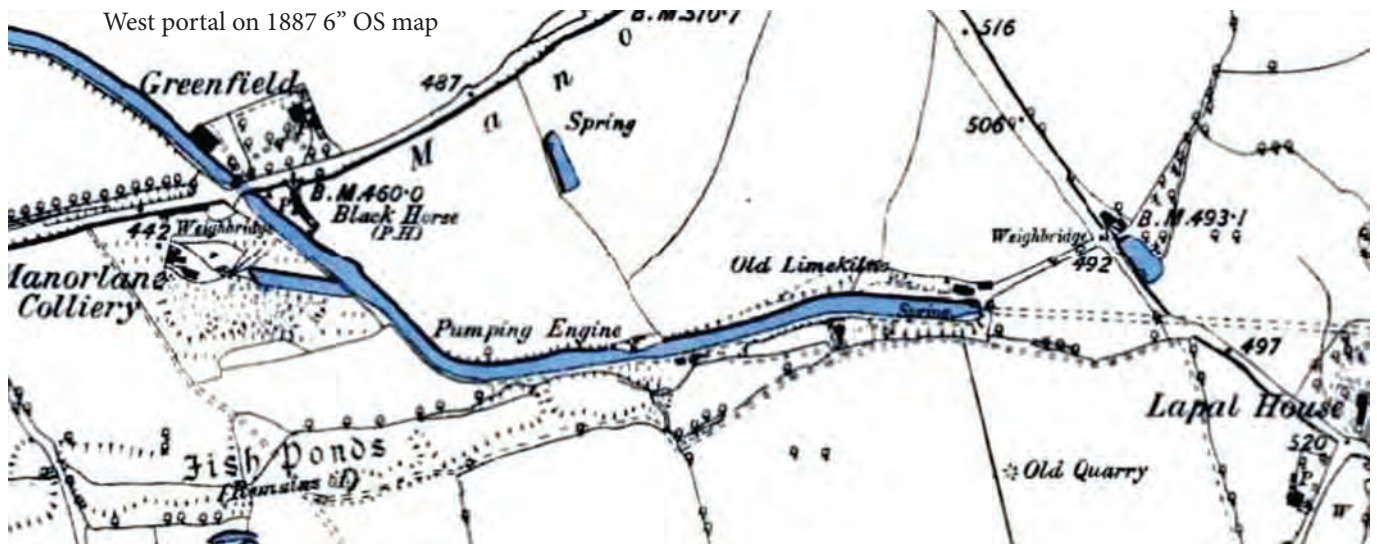
The move towards their developing into the true communications hub of the UK began about two centuries ago when James Brindley, and other engineers of his ilk, began to link such hamlets together with simple contour-following canals. These significantly increased the bulk quantities of fuel, raw materials and manufactured goods which could be traded in single journeys. But as this 'canal mania' began to take off – both here and elsewhere in the UK – some unexpected consequences also began to emerge.



The east portal of Lapal Tunnel at California. The California Inn is seen in the background. Photo from T. W. King Collection courtesy of Dudley Archives and Local History Service and the Black Country Living Museum

To meet this need, the Dudley (No 1) Canal was built and operated as the means to supply local industries. At first, it connected to the Birmingham canals via the cavernous Dudley Tunnel and later received an improved connection via the Netherton Tunnel. This meant that, in principle, coal could increasingly be taken to London via the Worcester & Birmingham (W&B) and Grand Union canals, to fuel domestic fires there. However, bureaucracy at the Worcester Bar, in the forms of paperwork and transshipment overheads, made for continuing and mounting frustration. The solution was soon found in the form of a second Dudley Canal.





Dudley No 2 Canal is built

To circumvent the bottlenecks in the Birmingham Canal Navigations, the Dudley No 2 Canal was constructed to become Birmingham's first by-pass! To achieve this, it had to be free from level-changing locks.

Such a route could be found if it took a (then rural) 11-mile route to straddle a valley in Halesowen (now the Leasowes) and then tunnel beneath an elevated valley (now the Woodgate Valley) just to the east of the village of Lapal. Heading east, it would emerge from the tunnel near the ruins of Weoley Castle and then meet the W&B in Selly Oak and hence the North Oxford (later the Grand Union) canal.

channel was filled in for the sake of safety. Thus, the Dudley No 2 Canal lay partially dormant until the formation, in 1990, of the Lapal Canal Trust (LCT).

The initial objective, which the LCT adopted and upheld for its first decade, was to recover and reinstate the derelict eastern 'half' (approximately 5.5 miles). This would require restoration of the Leasowes embankment section and, in due course, the 2.2 miles-long Lapal Tunnel. It was presumed that, although their original construction had been at the forefront of the then available civil engineering techniques, today's methods and materials should be more than equal to the challenge. It is



The west portal of Lapal Tunnel at Halesowen. The toll house is seen on the left. Tunnel charges are displayed on a board outside.

Opened in 1798, the northern section of this entire canal heading south to Halesowen proved to be straightforward and remains in water to this day. Conversely, the southern section which proceeded east via the Lapal Tunnel (old spelling Lappal Tunnel) presented more significant engineering challenges and was eventually closed in 1917, after 120 years of operation. Likewise the local approach sections were also decommissioned and the

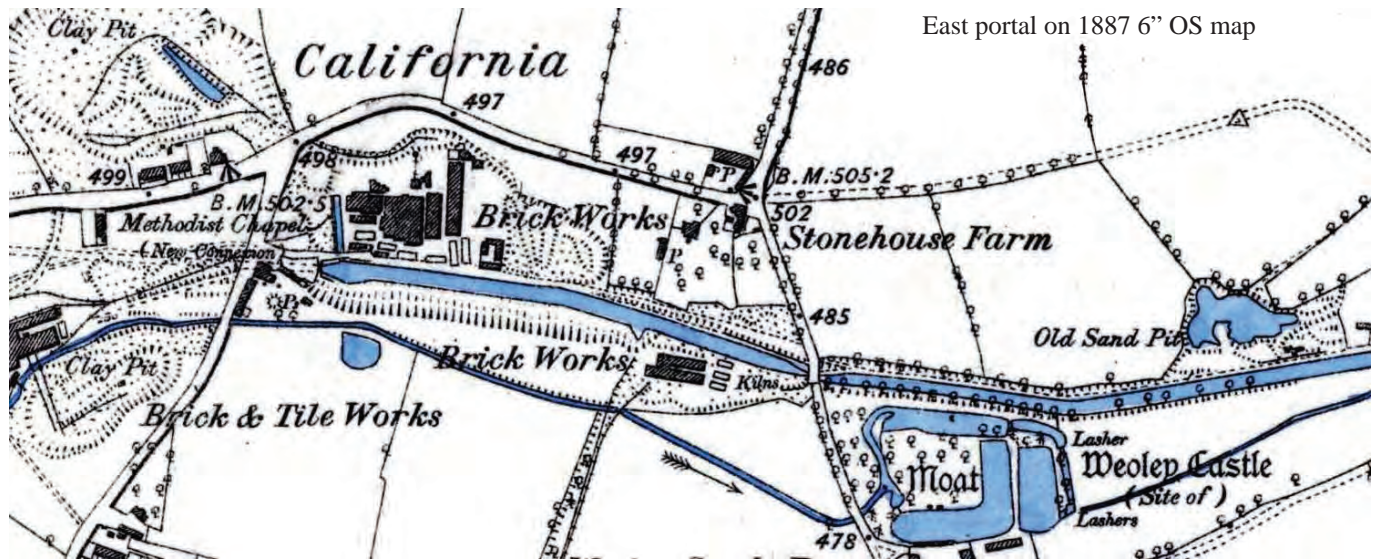
now useful to clarify a couple of issues. In Halesowen, the V-shaped Leasowes valley, being originally and lavishly landscaped by the poet William Shenstone, was required to tolerate the inclusion of a structure to take this canal across it. Archived correspondence shows us that serious consideration was given to the possibility of a steel aqueduct, perhaps on a par with that at Pontcysyllte on the Llangollen Canal. However, at the time, aqueducts were in their infancy whereas the earthen embankment, built on-site from near-site spoil, emerged as the 'tried and tested' solution.

Even so, at a height of 60ft above the floor of the Breaches Pool which it formed, the Leasowes embankment canal was to become the most steep-sided structure of its kind. Just over

a decade ago, Halesowen Council responded to LCT initiatives with a partial restoration of this structure into shallow water, so that it could continue to enhance this now hugely popular recreational parkland.

Lapal Tunnel

Approximately one further mile to the east of Halesowen, the village of Lapal sits on the summit of an escarpment ridge and the necessary tunnel to take this canal through



Looking east out of the California portal in 1961.
Photo from Edwin Fasham, Lapal Canal Trust

it, at the Birmingham Water Level, proved to be significantly more difficult to construct and maintain. It seems likely that the aptly-named construction engineer, William Underhill, may not have been fully familiar with the geology hereabouts and in particular, the alignment of the geological fault (approximately along today's M5 corridor!).

Despite his use of thirty vertical spoil-extraction shafts, the construction proved to be very challenging due to running water and running sand from roof-falls in certain sections. Spoil mounds from the excavations can still be seen at several locations in the Woodgate Valley country park and a now-collapsed shaft can be located at the rear of the Visitor Centre.

The resulting claustrophobic and compromised tunnel resembled a single-vessel-width drain-pipe having the classical profile for transit by 'legging', the then traditional means of transit through a low narrow tunnel. The brick-lined tunnel – only a small bore of 9 feet wide and 9 feet high above the water line – was sufficient for one-way working at a time. Mining subsidence, however, reduced this to a mere 7' 6" wide and 6' high in places, and was to prove troublesome throughout its operational life.

The original cross-section profile of the Lapal Tunnel resembled an inverted horseshoe with a flat bottom. This resulted in non-uniform pressures from the rock and marl strata, particularly at the two base right-angles and the vertical sides at about the water line. The latter bowed inwards in several places to give the tunnel an almost egg-timer profile. This action sometimes dislodged capping bricks in the ceiling arch allowing soft sand to pour in and plug the tunnel (over a short length).



A total roof collapse which probably occurred in 1954 was found $\frac{7}{8}$ mile from the California portal during a navigation of the Lapal Tunnel in 1961. Photo from Edwin Fasham, Lapal Canal Trust

As noted already, the Lapal Tunnel became operational in 1798 and remained viable for 120 years despite sometimes significant yet very localised roof-falls which necessitated repair with interim periods of closure. Indeed, although it had only opened in 1798 the tunnel was closed for repairs for two months in 1801 and again for four months in 1805.

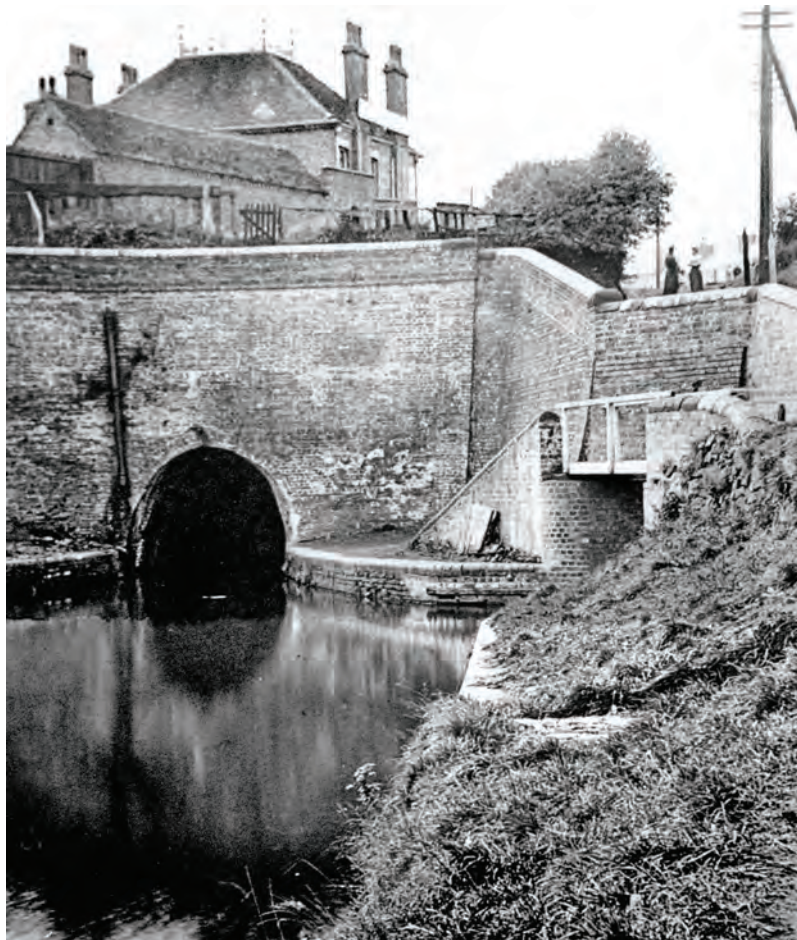
At 3,795 yards, the Lapal Tunnel enjoyed the distinction of having been the fourth longest canal tunnel in Britain. Only the Standedge (5,698 yards) on the Huddersfield



A collapse of the side wall ¾ mile from the California portal in 1961. Photo from Edwin Fasham, Lapal Canal Trust

Narrow Canal – which was reopened on 1 May 2001 after many years of dormancy, the Strood (3,946 yards) on the Thames & Medway (which is now a railway tunnel!), and the Sapperton (3,817 yards) on the Thames & Severn are longer.

In about 1841, the Lapal Tunnel was also augmented with a unique steam-engine pumping scheme developed and installed by Thomas Brewin, a colliery owner and a canal



The east portal of Lapal Tunnel at California. The bridge on the right spans a short arm of the canal to Stonehouse Farm Brickworks. Photo by H Hall from Bartley Green District History Group

company shareholder. In essence, his pump, comprising a reverse waterwheel powered by a steam engine outside the western tunnel portal, was used to raise by about 6 inches the level of water in the tunnel, and also the entire canal eastwards up to a stop-lock in Selly Oak. Then, as vessels entered the tunnel for what had previously been a four-hour transit (reduced to three hours by the provision of ‘professional’ leggers in 1829), this water would be released into the western canal, to cause an assistance current which effectively further reduced the average transit time to about two hours.

The procedure was then reversed to assist a platoon of boats heading in the opposite direction. However, there is some evidence that the flushing water may have also contributed additional wear and tear to the masonry and mortar, and so hastened the early demise of the Dudley No. 2 Canal. The following year the canal company was sufficiently impressed to present the inventor with £50 worth of silver plate.

A new engine was installed in 1882–83, and further improvements made in 1889–90. The engine ceased work in 1914, when through traffic was diverted to the Netherton tunnel, a much more commodious affair made in 1855–58 with two tow-paths.

As originally constructed and operated, the Lapal Tunnel was always a precarious structure. It is known that there were several further temporary closures during

its 120 years’ service, and its early closure in June 1917 when the tunnel was blocked by yet another roof fall was almost inevitable when the repair and operating costs outweighed the income in the years when canal usage went into decline. The tunnel was officially closed on 22 September 1926. The engine-house was subsequently demolished, and the canal outside the western portal backfilled with spoil during the construction of the Halesowen bypass. At this time, the tunnel was plugged with a large sewer pipe with a U bend in it rising to about six feet above the top of the tunnel portal. This ensured that the tunnel filled up to the roof. The tunnel water was then fed into the storm drain. A manhole cover is now the only evidence of the portal. The basin at the California end was filled with refuse and rubble in the mid 1960s and the site was landscaped in 1994/5. The airshaft was infilled in 1978, thus blocking the tunnel at this point. Today the only visual evidence that Lapal tunnel existed are a number of spoil heaps from construction shafts along its line.

It has been rumoured that motorway contractors opened up the Lapal Tunnel close to the west portal during the construction of the M5. There is no evidence to support this and when a written enquiry was made in 1966 British Waterways Board Engineering Department stated ‘it was





The west portal of Lapal Tunnel in 1953. Photo by Phyllis Nicklin

extremely unlikely as the depth of the tunnel below the line of the motorway was adequate to support any loading that the motorway might put on the tunnel'. It has, however, also been reported that the section under the M5 collapsed during construction of the motorway and was subsequently filled with concrete.



The bricked-up west portal in 1963; a few years before the cutting here was backfilled with spoil. Photo Richard Amott

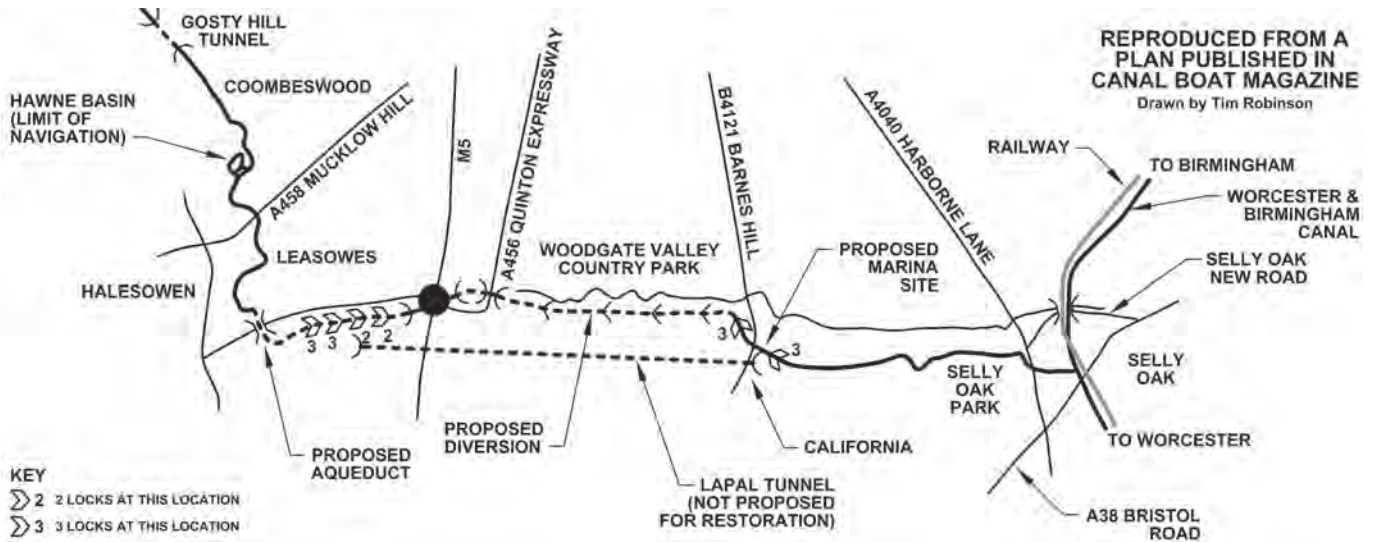
Restoration 'over the top'

Thus, when the Lapal Canal Trust commissioned its major Engineering Feasibility Study, from professional consultants Atkins, it is of no real surprise that they identified a significant series of issues against reopening the tunnel. In effect, these meant either an almost complete rebuild to modern diesel-engine-tolerating

dimensions or else a new alignment altogether: 'Over The Top' (OTT). The latter would call for locks to permit ascent and descent along the Woodgate Valley floor as a solution which could be built piecemeal as funds would allow, and the outcome would deliver recreational benefit to all manner of user communities, not just canal boaters. Now the Woodgate Valley escarpment has a substantial summit level which is approximately 100ft higher than the reference Birmingham Water Level. At this summit, the gradual incline of the Bourne Brook valley then becomes the considerably steeper western decline near the M5 motorway and the A456 trunk road junction. Geologically, the valley itself is a classical ridge structure with the scarp or steep slope (at its west) and a dip or gradual slope (to its east). In principle, either of these ascents could be implemented with ten locks (rising by about 10ft each) and separated by appropriate lengths of level pounds between them along the route of the bridleway which approximately follows the course of the Bourn Brook. This would amount to a total of twenty locks for the entire Lapal-OTT scheme to be a viable alternative to a reconstructed Lapal Tunnel.

Being preserved and designated as an open recreational green space, there is ample room along the entire valley floor to have a canal and tow-path which would, in effect, augment and enhance the existing bridleway. For several years, this twenty-lock OTT-scheme had become the LCT's main alternative restoration intention. But recently, an intriguingly novel alternative possibility is being discussed.





The diagonal lock

In the nearby West Midlands district of Solihull, engineer and boater Terry Fogarty had been refining his patent ideas for a canal structure which he has dubbed the 'Diagonal Lock'. In essence, it is intended to be a substantial length of reinforced concrete tube, of 'tunnel-like' dimensions, such that it may be installed within a natural slope of land (at about 45 degrees) between two adjacent sections of canal which are at (perhaps significantly) different levels. With the tube empty, a boat may enter from the lower canal and then close a gate to seal the low-end portal. Water is then admitted from the upper canal to fill the entire tube and thereby gradually float the boat up to the upper level from which it may emerge from an upper-end

portal when the levels equalise. Meanwhile, a boat in the upper level canal may enter the top of the Diagonal Lock tube for its crew to open the low-end paddle and empty the tube in a gradual and controlled manner.

Just like the conventional canal lock, boats may alternatively rise and fall in the diagonal lock except that the vertical displacement of the entire single structure can now be significantly more than the typical 10ft 'step' of the classic lock. On an incline which is sufficiently steep, it is plausible to install a single Diagonal Lock instead of a set of classic locks in a staircase structure, perhaps. Cost analysis has shown that a typical Diagonal Lock might break even were it to replace three or more conventional locks.



Accommodation bridge over the Lapal Canal in Selly Oak Park. This is an original bridge that was provided for pedestrians (and animals) when the canal was built in 1798. It is now believed to be one of Birmingham's two oldest surviving canal bridges although there are railings instead of the original parapet. Restoration of the canal is not permitted at present because of drainage issues. These will be resolved with the development of Battery Park where the Lapal Canal will connect with the Worcester and Birmingham Canal.

In the case of the Lapal project, it may be plausible to use a single Diagonal Lock on the Halesowen side of the Woodgate Valley to replace eight of the ten conventional locks which the OTT-scheme would otherwise require. The remaining two conventional locks would be used to correct the level differences required to get across the A456 trunk road into the Halesowen approach to the nearby Leasowes.

So, although there remains a range of engineering and land allocation details to be resolved, it seems worthy of further discussion that the former 2.2 mile-long horizontal Lapal Tunnel might just possibly be replaced by a tunnel-like tube structure as the first Diagonal Lock to be used in the restoration of a UK narrow canal.

Further information

Reference and Animation: Diagonal Lock website: www.diagonallock.org

Royal Observer Corps Centre, Bury St Edmunds

John Shere – ROCA Heritage Team

A Second World War ROC Ops Room has been found inside the Guildhall in Bury St Edmunds in Suffolk; it is believed that this is the only surviving example. This article looks at the story behind this and the workings of other WWII ROC Ops Rooms (Centres). If you are only interested in underground structures then look away now, for this is unfortunately above ground. However, the Guildhall is England's oldest complete civic building so this may tempt you to read more!

Background above ground

SubBrit members are generally knowledgeable about ROC Posts and some even own their own piece of Cold War history. Some have seen an ROC Group Control but there are very few left. The really rare items are the WWII ROC Operations Rooms. These should not be confused with the buildings at RAF Uxbridge and RAF Digby etc which were joint RAF and ROC manned Operations Bunkers. These of course really were mainly underground.

WWII ROC Operations Rooms (Aircraft Plotting Rooms) were almost always above ground and were commonly

called 'Centres'. There were also secondary Ops Rooms as back-ups. The later Nuclear Plotting underground buildings were then formally called 'Controls' but of course people always call them bunkers!

Before and during the start of WWII a team went around the country looking for suitable locations for ROC Ops Rooms. A natural choice was to use GPO telephone exchanges or Post Office buildings; these already had easy access to the telephone lines required. Many also had spare rooms and these became the obvious locations for Ops Rooms. As an example, the 20 Group ROC Ops Room in Truro was put into the old Post Office building. Almost all of these Ops Rooms found other uses after the war and any trace of their former use was stripped out. This is why almost none of these locations has survived. In Bury St Edmunds the wartime team looked at the telephone exchange building but for an unknown reason it was not deemed suitable. The good news is that they chose the Guildhall which was very close by. This historic building dates back to the thirteenth century and has been at the heart of the local community for over eight centuries.

Listed building

As the building was so important it was Grade 1 listed. It has also been used as a Court House, hospital (during the Plague), and prison for the town's monks. As a key Civic Building it was used as a council chamber, meeting place and library during its long local service. It was the building's Grade 1 listing that prevented the Ops Room from being completely stripped out. How had the ROC Ops Room – which was upstairs at the back of the building – been forgotten? Sadly the Guildhall had fallen into disuse in the last two decades. A trust was formed to restore it to its former glory and to create a Heritage and Exhibition Centre so that the public could enjoy it again.

At this point I must pay tribute to Air Vice-Marshal Mike Jackson who is the key person in making the project happen. When he and a colleague had a good look inside the building they found one locked room that was being used by the local Scouts and Guides as a storeroom for uniforms and other equipment. The room was opened once a week and the walls were covered in polo shirts, other items of uniforms and woggles. All the items disguised the original ROC features. The Plotting Table had gone so perhaps its history was not so obvious?

Friends in need

Mike Jackson luckily spotted this treasure and contacted the newly formed ROCA Heritage Team in 2012. He came to our first formal



The WWII ROC Control Centre at Norwich.
Photo from Justyn Keeble, ROCA Heritage Team





Kitty Best in the Ops Room/Shop

committee meeting and gave us a presentation about the Guildhall and the Ops Room. He explained that the key challenge of the now 'Friends of the Guildhall' was to secure money from the Heritage Lottery Fund.

A submission had been made to save this Ops Room by restoring it and rehousing the Scouts. A great deal of other work would be required inside the Guildhall including creating two event spaces, an education suite and a courtyard café. These were all included in the first submission to the HLF but were unfortunately later turned down.

This ROC Heritage meeting was followed by an invitation from Mike to Edwina Holden MBE, our Heritage Team Chairman, and myself to visit the Guildhall. This took place in July 2013. A private meeting had been arranged for about 25 local school teenagers to visit the building. Talks were given by Mike, an architectural historian and others on its history and how to read the history of a building. The final visit was; of course, upstairs to the Ops Room and this was the highlight of the visit.

A plotting table had been rebuilt and local surviving ex-ROC members contacted. They explained how it would have looked. One lady in her eighties could remember exactly where she used to sit. She then recounted the positions of all the people around the room. The key features were the plotting table, balcony and the long-range board. The balcony contained the following (in seniority): the Duty Controller who was an officer; Assistant Duty Controller; Post Controller (both of whom would be Chief Observers); and the Inter-group Teller. The balcony afforded an excellent overview of the Ops Room and its activities.

The future is in the past

The Guildhall team are very lucky to have two re-enactors to show how the room operated. Andy Bowles and Kitty Best both wear smart ex-Observer Corps uniforms on open days and have done extensive research using original manuals on the wartime plotting procedures.

During our visit Andy gave a superb presentation on the history of the Corps and the aircraft plotting role. To

make the whole thing more authentic Andy has made a full-size replica Post Instrument out of wood and a Snow Flake warning rocket. Andy explained how the Ops Room functioned, including a demonstration with Kitty sitting at the table carrying out plotting. They have been in touch with those who served at the Ops Room to ensure that their script is accurate.

I certainly learned a lot of things about the wartime role that I had not known before. Some may scoff that they are only re-enactors but they were very professional and held the attention of all the young people watching. This is not easy to do. As a result the story of the Observer Corps/ROC was accurately passed on to another large group of young people who will hopefully remember who we were. The role of the ROC during the Cold War was also recounted.

HLF bid is successful

The current position is that Mike and his team learned a lot from their first Lottery Fund submission and the second submission was successful. They plan to replicate a day during the Battle of Britain. At that time the long-range board was not used. They may show an example of one of these in a separate ante-room which will show the ROC's history including its role during the Cold War.



Edwina Holden MBE, Andy Bowles and Kitty Best
– note how low the head-room is underneath the balcony!

Visitors should be able to see a complete plotting action from Observer Post to table plotting and communicating to the RAF. This will mainly be through film and recordings. The Bury St Edmunds team are now working with outside help to get the building ready to receive visitors. The Ops Room could be open to the public in late 2016 – meanwhile see the website:

This year there is an Open Day planned for Saturday 13 September. Four presentations will be given in the Ops Room starting at 1030 hrs and each one will last one hour. However, these need to be booked in advance.

Referring back for a moment to Truro, they moved their Ops Room in 1942 from the Old Post Office building in High Cross to the Masonic Hall in Union Place. It is a strange coincidence that some of the local ROC officers





View from the balcony

were also Masons! This Ops Room closed at the end of the war but reopened in 1947 on the reformation of the Corps. In 1980 the Masonic Hall was demolished to form part of the site for a new Marks & Spencer store.

Royal Observer Corps goes to sea

You will all have seen something of the celebrations for D-day. It was almost unnoticed that there was no mention of the almost 800 Observers who crossed the Channel with the D-day fleet. To augment the invasion force, merchant ships were also pressed into service and many had American crews. Prior to D-day their gunners and the Navy had unfortunately shot down a number of our own allied aircraft. Blue on Blue is not new!

A team of ROC volunteers was specially chosen from the finest aircraft observers and a total of 1,405 were selected for final training. From these 796 got through the medical tests and intensive training in aircraft recognition and naval procedures. They were given the equivalent Petty Officer rank of Aircraft Identifier, wore a RN armband and the special Seaborne ROC uniform flash.

On board the D-day ships, gunners would now only be allowed to engage an aircraft if permission was given by the Observer. Many had hair-raising experiences at sea. Two Observers were killed, two were injured and twenty-two survived their ships being sunk. A total of ten were later Mentioned in Despatches. More information can be found on our website: www.roca-heritage.co.uk. Currently we believe that there are only twelve Seaborne Observers still alive. All were invited to the recent commemorations in Normandy but none was able to go.

We in the ROCA remember them all. How many Allied airmen's lives were saved by the accurate observation skills of these volunteers in ROC uniform? Sadly, we will never know.

Visit to the Bury ROC Centre

Some time ago Terry Bottrill of Stoke Golding Post suggested that there should be a function where ROC Post owners could meet together. For such an event I had planned to do a practical presentation/workshop on how the ROC Group Controls used the information from Posts. This would show how we used the Post Display Boards, triangulated the information and calculated the bomb burst information. I would use my 1/3rd scale, home-made Triangulation Table and all the original calculators.



Plotters at work in a WWII ROC Operations Centre.
Photo copyright IWA, reproduced under creative commons licence

The plan was to pass on the little-known skills (I did it for real at Bedford Group Control) to others. I had considered using Newark Air Museum as the venue but it has now been suggested that we should use Bury St Edmunds.

A special open day has been arranged for Sunday 19 October. This is principally for SubBrit and ROCA members with ROC Post owners especially welcome.

The whole building will be open and the re-enactors will also show how the WWII Ops Room worked. I will do my Cold War demonstration and a mini-exercise. There will be a charge for the day (TBD). This will be shared between the Guildhall Charity Fund and the ROCA Heritage Fund. Refreshments are planned but more details and timings will be confirmed later.

New photos John Shere



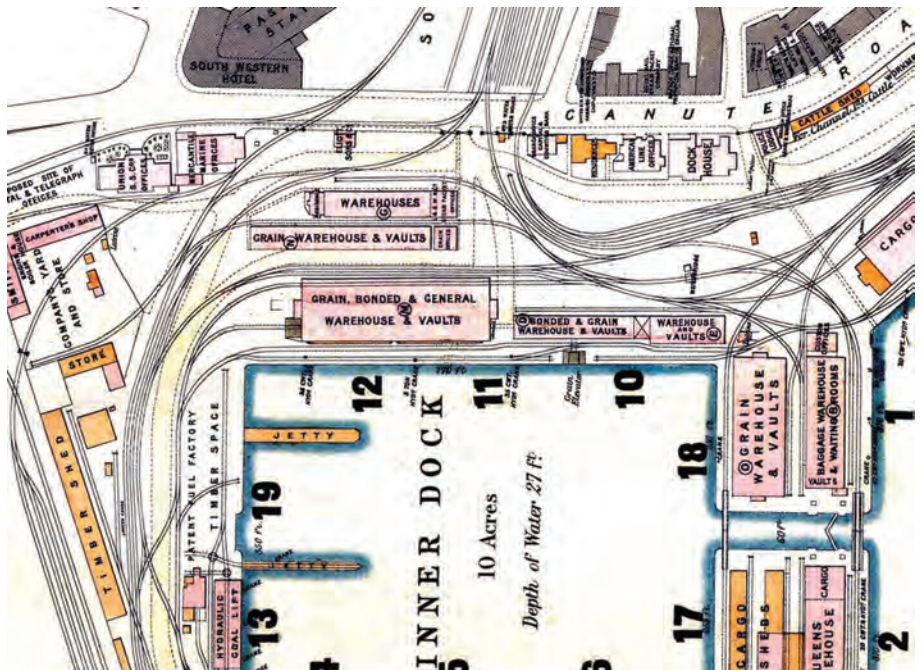
Southampton Docks fortified telephone exchange and Docks Control Bunker

Nick Catford

There is evidence of settlement in the area now known as Southampton as far back as the Stone Age, but no trace of boating or port activity. The Romans settled the site (Clausentum) around 70 AD. They established a busy port, serving the large towns of Winchester and Salisbury. The settlement was abandoned when the Romans left Britain in 407 AD. The Saxons founded a new town across the river Itchen from the Roman site around 700 AD and the port traded with France, Greece and the Middle East, exporting wool and importing wines and fine pottery.

The Saxon town began to decline during the tenth century but a mediaeval town known as Hamtun grew up nearby. It became an important departure point for English armies on their way to France. In 1620, the Pilgrim Fathers departed from Southampton for Plymouth and North America on the *Mayflower* and *Speedwell*. The 16th and 17th centuries were another period of decline for Southampton, as other ports (such as London) competed for business.

The modern port of Southampton dates from 1836 when the Dock Company was incorporated. By 1851 the core of the Eastern Docks had been completed. The area that we are interested in is immediately south of Canute Road and is shown on the 1897 Dock Plan reproduced here. Two 19th-century warehouses are shown: that to the south identified as a grain warehouse and designated N; that to the north was designated as G. The warehouses in and

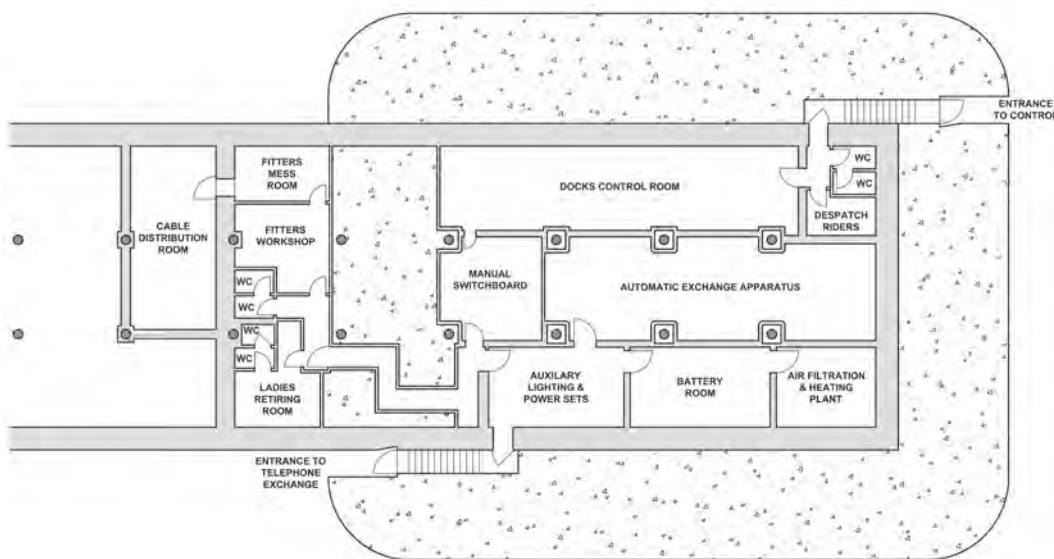


1897 Dock Plan showing the N warehouse around the old Inner Dock were identified alphabetically. A spur of the dock railway network runs between them. **Second World War damage**

During WWII Southampton Docks were a major target for German bombers and both warehouses were destroyed in an air raid on 30 November 1940, leaving only the basement of the N warehouse intact. The following year, the Docks telephone exchange also took a direct hit. To replace it, a heavily fortified and partially subterranean telephone exchange and Docks control centre was built by the Southern Railway who owned the docks. It was built on the site of the N warehouse with the surviving outer walls and ceiling of the brick basement being incorporated into the new structure which was 100 feet

long by 84 feet wide.

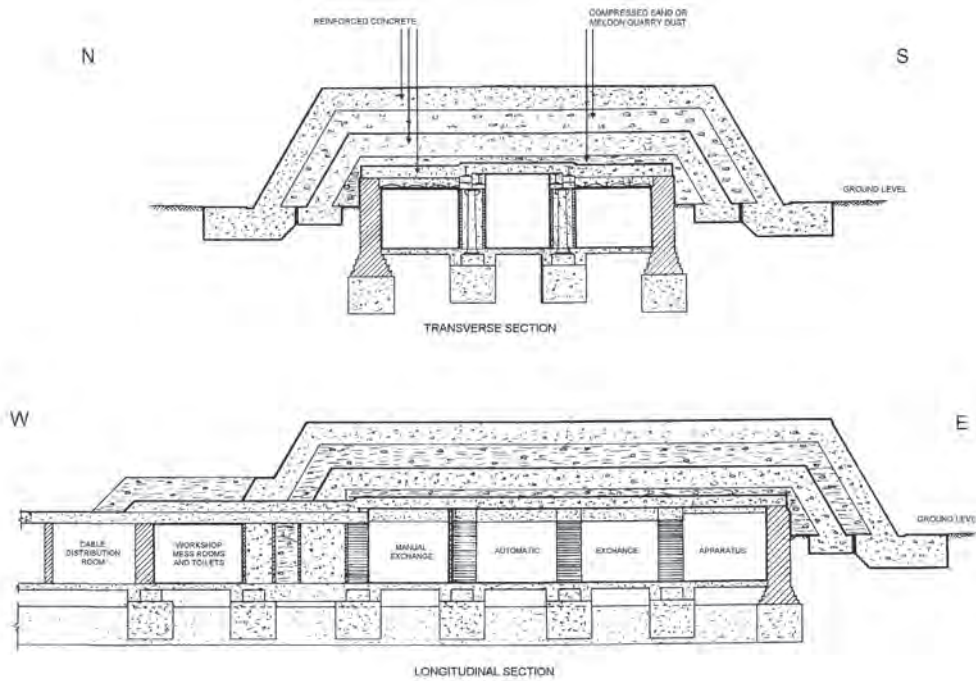
All movements in the docks were controlled from here during the latter years of the war including the D-Day landings; the bunker then remained in use into the Cold War. The Southern Railway also built an underground control centre into the bank to the east of Southampton station. This controlled the railways of the Southern District and was similar to other Southern Railways WWII



SOUTHAMPTON DOCKS TELEPHONE EXCHANGE AND CONTROL ROOM - PLAN OF UNDERGROUND LEVEL

Drawn by Tim Robinson





were used by the Docks photographer. The brick outer walls of the basement of the nineteenth-century N warehouse were incorporated into the bunker to form the outer walls of the bunker below ground level. They were underpinned with concrete. A new concrete floor was laid over that of the warehouse basement. Surviving cast-iron columns from the warehouse were encased in brick to form piers within the new building.

underground control centres at Orpington, Redhill and Weybridge.



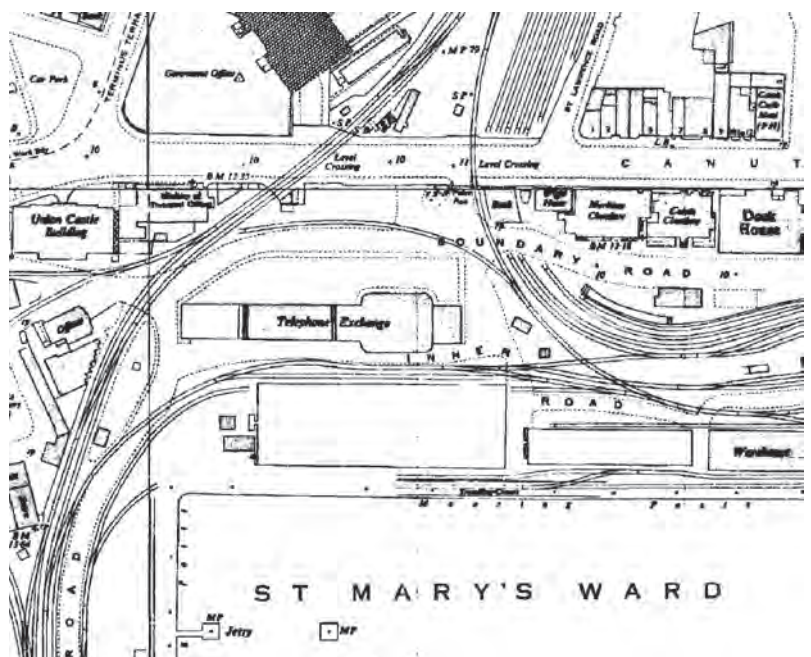
Bunker during construction in 1942



The completed bunker seen from the northeast. The entrance to the Southampton Docks control room is seen on the corner. The remains of the M warehouse are seen behind the bunker

Planning for the new structure started in early 1941, and construction took place during the summer of 1942. The telephone exchange utilised the bulk of the single-storey bunker with the Docks control room located in one room in the northeast corner.

The building was divided into two distinct areas. The west end of the building had a low flat roof and housed a cable distribution room, workshops and mess rooms. The central section below the fortified roof contained the exchanges. The two sections of the building were linked by a dog-legged corridor that passed through the bunker wall. At the east end of the bunker there was a brick vent shaft with a later brick building with nine small rooms partially surrounding. The use of this building and date of construction are not known. In later years one of the rooms was used as a garage for the Port Director's limousine and a couple of the offices



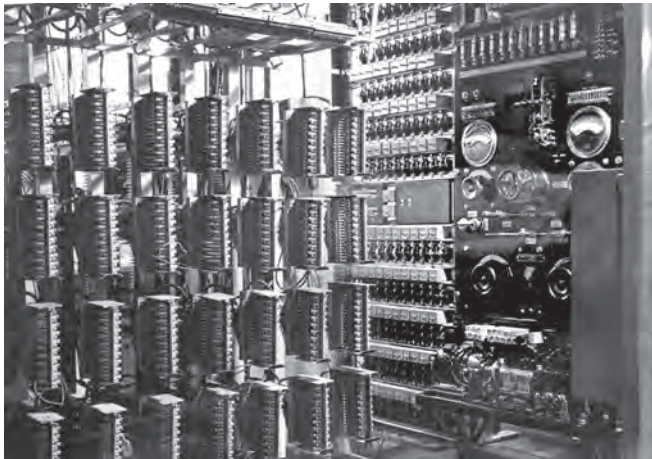
1953 1:2,500 OS map shows the telephone exchange bunker on the site of the N warehouse



The roof of the bunker was heavily fortified. It was 12 feet thick with five alternating layers of sand mixed with quarry dust and reinforced concrete on top of the original barrel-vaulted basement ceiling. These layers came down the side of the building to a two-layer concrete apron around the bunker.

Camouflage paint

The exterior of the bunker was almost certainly painted with dazzle paint. This comprises a complex pattern of geometric shapes in contrasting colours, interrupting and intersecting each other. It was used extensively to camouflage ships in WW1 and to a lesser extent in WWII. This paint may have been a later addition as it is not visible in photographs taken in 1943.



There were three doors out of the plant room. One door to the right led into the battery room and next to that was the air filtration and heating plant. Back in the generator room a door straight ahead led into the largest room in the bunker, the automatic exchange apparatus room.

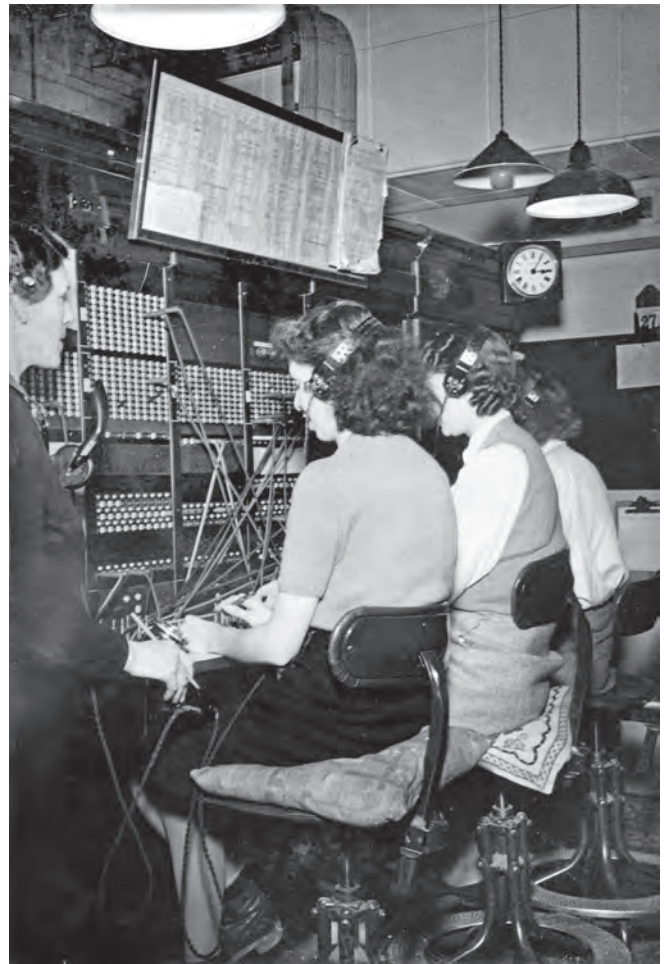
The final door from the generator room was to the left and led either into the manual switchboard room by turning right or into the dog-legged corridor leading to the less protected western end of the building by turning left.

Beyond the switchboard room was the Docks Control room.

It is Siemens 15 equipment. The Southern Railway bought nearly all of its telephone equipment from Siemens

The bunker was divided into 18 rooms and the internal walls were made of brick. There were two entrances. The entrance to the telephone exchange was at the southwest corner and consisted of a covered porch over a flight of twelve steps which provided access from ground level down to the bunker floor level. There was a blast door at the bottom of the stairs and a short corridor which led into one of two plant rooms. A large Lister generator sat in the centre of the room and when inspected in 2000 it had 300 hours on the clock. Air-conditioning plant was located against the wall.

This also had its own entrance with another covered porch in the northeast corner of the bunker over a flight of twelve steps down to a second blast door and bunker floor



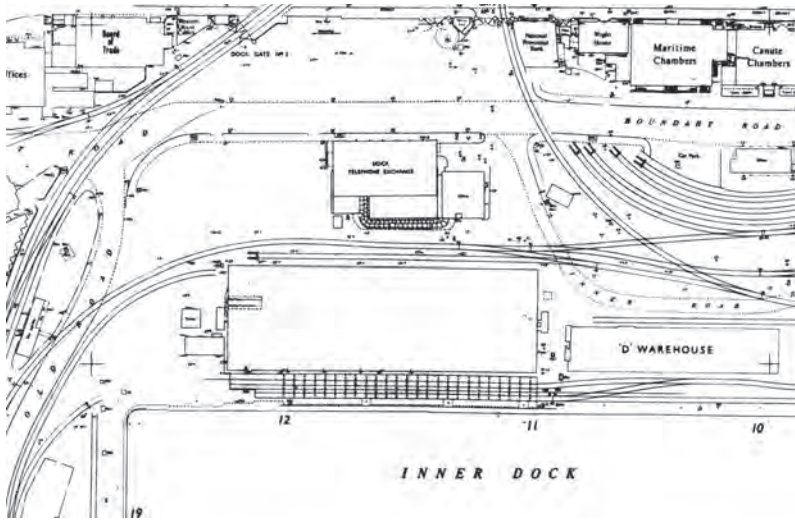
The manual switchboard used for connecting calls that could not be dialled. The supervisor is seen on the left

level. Once through the door there was a toilet with two cubicles and a small despatch riders' room and then the Docks Control room.

Minor refurbishments were carried out in the mid-1950s including the addition of an emergency exit. These seemed to improve the defensive nature of the building; perhaps they were in response to some perceived Cold War threat. In the Southampton Corporation civil defence



Southampton Docks Control Room



1959 Southampton Docks survey shows the new telephone exchange that was built on top of the bunker

scheme of the 1950s and 1960s the Port HQ was a sector post so presumably this would have been the bunker. The docks had their own Civil Defence Corps like all major British Transport Commission docks so the Sector Post was manned by Docks Civil Defence. It would seem logical to have the port control there but there is no evidence to support this. The RNXS Port headquarters in the 1980s was in part of the old seaplane terminal building with a forward observation post at the Navy College at Hamble.

A modern telephone exchange was built on top of the bunker in 1958 so that it could utilise some of the equipment already in place in the bunker below; it came on line on 29 July. On 15 November 1962 the new Dock House administration building was opened immediately to the north of the bunker alongside Canute Road and opposite the Terminus Station. By this time much of the building was redundant and was largely for the storage of old files etc. One of the rooms was used as a charity shop but this closed when the person who ran it retired. The old DC electricity supplies in the bunker were disconnected on 31 August 1978 and the building was supplied from the



The automatic exchange apparatus room looking west mid-1980s. The door at the back of the room is into the generator room. Note brick pillars which surround the original cast iron columns in the N warehouse basement. Photo from Sub Brit Collection

AC supply from the exchange above. At some time during the 1980s, the telephone exchange building was renamed Unit House and was also occupied by the Port Security (Unit Security Services) along with other users.

Site becomes housing

The telephone exchange above the bunker was used until the Docks administration centre was relocated to Ocean Gate on 2 April 1991 and a new digital exchange was built. Dock House remained empty (apart from storage in the basement) until sold. At that time the bunker was judged too solid to be demolished. After lying empty for a decade the bunker and Dock House were both sold to Banner Homes on 18 July 1999. They gained planning permission to build apartments on the site. Modern concrete-busting equipment finally put paid to the bunker and it was demolished in 2003. The site was then sold to Persimmon Homes who went on to develop it.



The new dock telephone exchange was built on top of the bunker in 1958. The building on the left is also a later addition. The entrance in the corner of the bunker is into the Southampton Docks control room.

Photo from Sub Brit Collection

Prior to the demolition of the bunker the Southampton City Council archaeology team recorded the building (reference code SOU 1027). The record was made in February 2000 on behalf of Banner Homes Group plc. Their report can be consulted in the Special Collections section of Southampton Central Library in the Civic Centre.

Sources:

Report on the archaeological building survey of the former telephone exchange at Dock House, Canute Road Southampton SOU 1027. Report made by Southampton City Council Archaeology Unit

The Building of Southampton Docks Dave Marden – JMD Media 2013

Old photos from The Associated British Ports archive of historic photographs held in the Southampton City Council Collection.



The Atlantic Avenue subway tunnel, Brooklyn, New York

The Atlantic Avenue Tunnel (aka Cobble Hill Tunnel) in Brooklyn is the oldest subway (railway) tunnel running beneath a city street in North America. The tunnel was built in 1844 beneath a busy street in the City of Brooklyn (the suburb did not become part of New York City until a half-century later).

The tunnel is 839 yards long, 21 feet wide, and 17 feet high and accommodated two standard-gauge railway tracks. It was built in only seven months by the cut-and-cover method; only hand tools and primitive equipment were used in its construction. Its purpose was to provide grade separation for early Long Island trains that lacked brakes good enough to operate on city streets.

It was built mainly to satisfy public demand for a separate right of way for the Brooklyn and Jamaica Railroad (later Long Island Rail Road) on its way to the South Ferry at the foot of Atlantic Street, where passengers could catch ferries to Manhattan. The tunnel avoided vehicular and pedestrian traffic conflicts and delays. Grade separation is a process used to improve traffic flow with road or rail surfaces being constructed at a different level, or elevation, to each other.

In 1861, the New York State Legislature voted to ban railroad locomotives from within the limits of the City of Brooklyn and the tunnel was abandoned and sealed.

In March 1916, the Bureau of Investigation suspected that

folklore and legend. In 1936, the New York City Police Department unsuccessfully attempted to enter the tunnel, in order to look for the body of a hoodlum supposedly buried there.



Visitors climbing through the hole in the bulkhead wall and down the steps into the subway

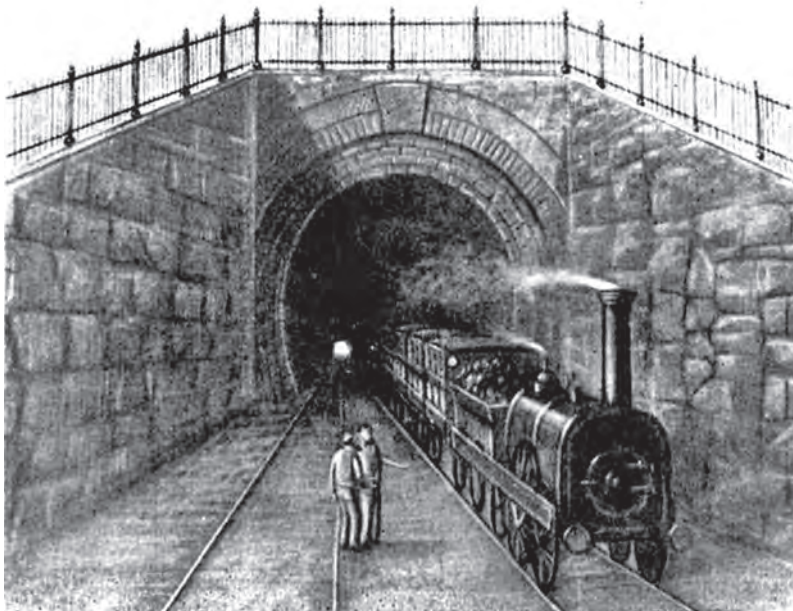
In 1941 it was rumoured to have been inspected by the Federal Works Progress Administration to determine its structural strength, but there is no evidence of this. A few years later, it was once again rumoured to have been opened, this time by the FBI, in an unsuccessful

search for spies; however, there is no evidence of this either.

Local enthusiast Bob Diamond rediscovered the long-forgotten Atlantic Avenue Tunnel in 1980. He entered the tunnel by prizing open a manhole cover he had located at the junction of Atlantic Avenue and Court Street, crawled a distance of 70 feet underground through a partially filled-in section of tunnel less than two feet high, and found the bulkhead wall that sealed off the main part of the tunnel. With the assistance of a Brooklyn Union Gas Co. engineering crew, he broke through the massive concrete wall, which is several feet thick. This gave him access to the tunnel.

Preservation attempts

The Brooklyn Historic Railway Association was formed in 1982 to preserve, publicise and provide public access to the historic tunnel.



1845 drawing of the entrance to the Atlantic Avenue Tunnel

German terrorists were making bombs in the tunnel, and broke through the roof with jackhammers. They found nothing, installed an electric light, and resealed the hole.

Rumours abound

In the 1920s it was rumoured that the tunnel was being used for both mushroom growing and bootleg whiskey distilling even though there was no access into the main part of the tunnel. It soon became an object of local

Bob Diamond made a career out of giving tours and was even granted a licence by the City. Tourists would line up in the middle of the busy road, descending a narrow ladder one by one into a tight passageway. This led to a small opening he had made in the bulkhead wall close to the tunnel roof. From here visitors descended a wooden stairway which was built by Diamond and his colleagues in the 1980s.





Public entrance to the tunnel in the middle of Atlantic Avenue, with traffic passing either side

Diamond had great ambitions for the subway, including running a trolley through it, and excavating the 177-year-old steam locomotive that he claims is “almost definitely buried at one end”. (We’ve heard that old chestnut before! *Ed.*)

But in 2010, the city authorities revoked Diamond’s licence to use the tunnel and shut the tours down, citing safety concerns. Diamond sued for access, but was unsuccessful. The manhole has now been welded shut.

Sources:

Grist (blog), 6 February 2014

Wikipedia

The Brooklyn Historic Railway Association website:

http://www.brooklynrail.net/proj_aatunnel.html

Canada’s other secret nuclear bunker

Andrew King – *Ottawa Citizen*

The Diefenbunker, once a top-secret military installation in Carp, 30 kms west of Ottawa, is now a museum with thousands of curious visitors passing through its solid steel blast doors.

The story behind the Diefenbunker is now widely known – during the Cold War, in response to the growing Communist threat of an intercontinental nuclear missile attack, this four-storey underground Emergency Government Headquarters was commissioned in 1958 by Prime Minister John Diefenbaker to protect key government officials in the event of a nuclear attack. But there’s another Cold War bunker in the Ottawa area, abandoned because it flooded during construction.

The workers who built the Diefenbunker laboured under a cloak of secrecy. This 100,000 square foot underground bunker was built in the quiet village of Carp by Defence Construction Canada in about two years. Extensive research and design work by the National Research Council and the Defence Research Board made sure the facility could withstand a five-megaton nuclear blast within a two-kilometre range.

EASE, was completed in 1961 and was fully operational until it was decommissioned in 1994.

Project EASE was so secret that it is not commonly known that the Carp Diefenbunker is not the original bunker site, but a backup after a first bunker was compromised. This original bunker was excavated at a remote location in the solid rock of Lanark County before it was abandoned in favour of the Carp site.

Little is known about the original bunker. Construction began a year before the start of the Carp project. An Internet search provided information that the location was abandoned after groundwater flooded the operation 10 kilometres west of Almonte. Using coordinates and a radius projection mapped on satellite images, the site of possible remains of the flooded and abandoned bunker site has been found. Noting that the dimensions of the completed Carp bunker are 160 feet by 160 feet, an oddly square shape of those same dimensions was found near Pakenham. The dimensions of the Diefenbunker were overlaid on the shape. It was an exact match.



Many construction workers were unsure of what they were building and sworn to secrecy in the interest of national security. Still, the bunker used over 32,000 tonnes of concrete with walls five feet thick. The ambitious facility, built under the code name **Project**



The flooded hole



Located deep within the rugged terrain of Lanark County, this seemed like a logical place for a nuclear bomb-proof bunker. Using the natural protection of the solid igneous rock of the Canadian Shield, this site would also be remote enough to be away from prying eyes and allow construction to proceed in secrecy.

Carved out of solid rock, a flooded hole four storeys deep has been found in woods. A long-abandoned overgrown construction road was probably used to access this secret site in 1958. Many tell-tale signs of construction still remain – huge piles of crushed, blasted rock lie in piles surrounding the pit that would later be used as back-fill

to cover the four-storey concrete bunker box and help to absorb a nuclear blast.

Unfortunately, after construction hit groundwater, the site flooded, submerging the lost bunker. With the site now compromised, a secondary site had to be found. That was in Carp, where the new bunker was built and remained in operation until 1994.

A short film of an expedition to the site is at <http://ottawacitizen.com/news/local-news/the-other-top-secret-bunker>

The Ottawa Citizen, established in 1845, is the Canadian capital's leading daily newspaper.

Sir Edward Watkin, Railway Entrepreneur Extraordinaire

Stewart Wild

Nick Catford's article in *Subterranea* 35 (April) about the tunnels under Lord's cricket ground in London mentioned Sir Edward Watkin (1819–1901), chairman of the Manchester, Sheffield, and Lincolnshire Railway Company, which later became the Great Central Railway. Sir Edward was an energetic protagonist of great Victorian railway enterprises. Among his achievements were underground railways in London, an attempt to dig a tunnel under the Channel in 1880 and the planned construction of a tower at Wembley in northwest London in the 1890s that was intended to rival the Eiffel Tower in Paris. He was elected to Parliament on three occasions, knighted in 1868 and made a baronet in 1880.

Early business acumen

Watkin was born in Salford, Manchester on 26 September 1819, at the very end of George III's reign,



the son of wealthy cotton merchant and prominent businessman Absalom Watkin and his wife Elizabeth. He was educated privately, then joined his father's cotton mill business, later becoming a partner. In 1845, aged only

26, he founded the *Manchester Examiner*, a radical weekly newspaper that later merged with the *Manchester Times*.



A section of Watkin's attempt to build a Channel Tunnel can still be seen at Folkestone Warren. Photo Nick Catford

It was a time when railway mania was sweeping the country. Watkin, more interested in the future than the past, lost interest in cotton and newspapers and at the end of 1845 joined the new Trent Valley Railway in the position of Secretary. The TVR line was then under construction between Rugby and Stafford and is now part of the West Coast Main Line.

Within a year the company was sold to the London and North Western Railway (LNWR) for the colossal sum of £438,000. Watkin probably did quite well out of it since he negotiated the sale and then joined LNWR as assistant to the General Manager. Ever ambitious, in 1853 he accepted an offer to join, as General Manager, the Manchester, Sheffield, and Lincolnshire Railway (MS&LR) which had been formed six years earlier by the amalgamation of three smaller lines.

Achievements in Canada

In June 1859, Henry Pelham-Clinton, Duke of Newcastle, who had been the MP for South Nottinghamshire for fourteen years (1832–46), became Secretary of State for the Colonies in Palmerston's government. The following year the Duke accompanied the Prince of Wales on a fact-finding visit to the USA and Canada.

When, in 1861, the Government in London decided that some degree of reorganisation was needed in Canada, the Secretary of State asked Watkin, whom he knew, to undertake such a mission. Over the next few years, while the USA was in the throes of a Civil War, Watkin organised the confederation of the five British provinces into the Dominion of Canada, brought the Hudson Bay territory under Government control, and enlarged the railway network to bring Quebec within closer reach of the rest of Canada and of the maritime provinces. His achievements were to earn him a knighthood in 1868.

Back in England, Watkin resigned from his role as Manager of the MS&LR, objecting to a decision taken in his absence to do a deal with the

Midland Railway by sharing access into Manchester; as a major shareholder however, he retained his seat on the board. He was appointed President of the Grand Trunk Railway of Canada, whose headquarters were in London – you can still see the words GRAND TRUNK RAILWAY high on the side of their building in Cockspur Street.



A landslide occurred at the Warren (Folkestone) in 1877, closing the line for three months and destroying over 100 yards of the Martello Tunnel. The official reopening is seen here. Alongside the train are Mr. Newborn (director), Hon. James Byng (director), Sir Edward Watkin (chairman), Mr. John Shaw (secretary), Mr. Charles Sheath (clerk to the chairman) and the guard is Mr. George Privet, who later became one of the SER's first two district superintendents.

The following year Sir Edward returned to the MS&LR as Chairman, remaining in that role for the next thirty years. The development of railways was clearly his passion – he

advised the Government on the future Canadian Pacific Railway, on the development of railways in India, and was a director of nine railway companies in Lancashire and Yorkshire.

In 1872 he agreed to become Chairman of the ailing Metropolitan and St John's Wood Railway (M&SJWR) and in an attempt to win more traffic sought to extend the line north beyond Swiss Cottage. By 1880 the railway had reached Neasden and Harrow.



Shakespeare Colliery near Dover. Only 1,000 tons had been raised by 1912 and the colliery closed in December 1915

The first Channel Tunnel?

His overriding ambition was to link Manchester, London and Paris by rail, with a tunnel under the English Channel. To that end he backed the formation of a Channel tunnel company in 1872, although digging at Shakespeare Cliff between Folkestone and Dover did not start until 1880.

There was much opposition to the scheme and many feared that the tunnel could potentially facilitate a French invasion – even Queen Victoria apparently expressed her displeasure. Sir Edward, now MP for Hythe (1874–95), introduced a private member's bill, which was debated and then thrown out. The project was finally halted years later by legal action; the full story can be found on our Sub Brit website.

In the meantime, Watkin was also behind a scheme to bore exploratory shafts in an attempt to find coal in the Dover area, another unsuccessful project.

Another Watkin ambition was a new main line to link Sheffield and the MS&LR to the capital, and Marylebone was chosen as its London terminus. The line eventually opened on 8 March 1899, another piece in the railway jigsaw that Watkin hoped would eventually link Manchester directly with Paris. The Great Central Railway and the Metropolitan became one company in 1905.

London's first theme park and plans for the world's tallest tower

In 1889 Watkin was the brains behind the creation of a



public amusement park on land beside the Metropolitan railway at Wembley where the company bought and developed part of a private estate. Fresh landscaping included a cricket pitch and a boating lake. To serve what he hoped would be large numbers of Londoners seeking relaxation and leisure in the Middlesex countryside, a station named Wembley Park was built and opened on 12 May 1894.

In Paris, Gustav Eiffel's controversial masterpiece, a huge tower made of iron, had been drawing enthusiastic crowds since the Universal Exhibition of 1889. Watkin decided that London should have something similar, and where better to build it than alongside his Metropolitan railway at Wembley Park? The plans called for a huge three-level tower reaching to a height of 1,200 ft (366 m), greatly exceeding Eiffel's tower at 1,063 ft (324 m) to the top of the radio mast.

It is said that Watkin invited Eiffel to mastermind the project, but the great French engineer declined. No fewer than 68 designs were submitted in an international competition; eventually Sir Benjamin Baker was chosen as the design engineer; he had been involved in the construction of the Forth Bridge.

As the twentieth century dawned, Watkin's Tower, as it was known, had reached the first stage, but technical difficulties, mainly subsidence, allied to a shortage of funds brought construction to a halt in 1899. Watkin



Watkin's unfinished version of the Eiffel Tower in Wembley

died two years later and his ugly unfinished Wembley first-stage tower was demolished in 1907, thus the Eiffel Tower remained the world's tallest structure until the Empire State Building was completed in 1931.

The British Empire Exhibition of 1924 and the old Wembley Stadium (1923) were built on the foundations of Watkin's ill-fated tower; the new Wembley Stadium occupies the site today.

Watkin died in 1901, aged 81, at his home in Northenden, Manchester. He is buried nearby in St Wilfrid's graveyard; the church contains a commemorative plaque. His son, Alfred Watkin, became MP for Grimsby in 1877 and succeeded to the baronetcy.

Some Historic Mine Sites in Co. Kerry, Republic of Ireland

Kerry is the southwestern-most county in the Republic of Ireland. Two somewhat remote coastal areas, almost as far west as you can get, are of subterranean interest.

At Valentia (or Valencia) Island, south of Dingle Bay and about 65 km west of Killarney, slightly metamorphosed mid-Devonian silts and sandstones are exposed, known and worked as the Valentia Slate. Commercial extraction was commenced by the Knight of Kerry in 1816, and by the 1860s 400 men are said to have been employed here. Much of the output was exported to England. The mine entrance was blocked by a rockfall in 1911, which was cleared in 1998. Slate extraction has been recommenced, by Valentia Slate Ltd. Nearby a site owned by Ireland's National Parks Department is of outstanding geological interest, as the fossilised footprints of a tetrapod amphibian are beautifully preserved on a bedding-plane. We have only the footprints, as no bones attributable to the beast have been found. But this trace fossil has been interpreted as something like a metre-long salamander in appearance. In the mid-Devonian (around 385 million years ago) there were as yet no mammals, and no dinosaurs. In fact plants and animals were only just beginning to colonise the land. The Valencia beast is thus amongst one of the very first land vertebrates known.

Further south along the coast, beyond the Kenmare river estuary, is Allihies (also known as Cluin), the site of copper-mining remains from the Bronze Age onwards. This is about 45 km west of Glengariff. The modern phase of mining (opencast at first) commenced in 1816. Chalcopyrite (a copper iron sulphide) and tetrahedrite (a copper antimony sulphide) constituted the principal ore minerals, these being converted by oxidation to the bright blue and green azurite and malachite (copper carbonates) closer to the surface. They occur in quartz veins in the folded Upper Devonian silts and sandstones. In 1842 the concern was operated by the Bearhaven company, and in 1862 to facilitate deep mining an engine-house (to operate a man-engine) was erected at the Mountain Mine: this still stands. Also to be seen are relics of the ore dressing floors, and a number of miners' cottages, collapsed shafts, and so forth. Ore concentrates were sent to Swansea in South Wales for smelting.

Also in this district is a very early 19th-century road tunnel, between Glengariff and Kenmare, the Drenodrohur road tunnel made in 1836 – 37.

SOURCE:

Chris DARMON, 2008, SW Ireland 1: Valentia Island, a place of geological surprises. *Down to Earth* 65, 7 – 9.

SOURCE: Chris DARMON, 2008, SW Ireland 2: the copper mines of Allihies – an Irish story. *Down to Earth* 65, 10 – 12.



SB Visit to Godstone Hill Quarry, 28 June 2014

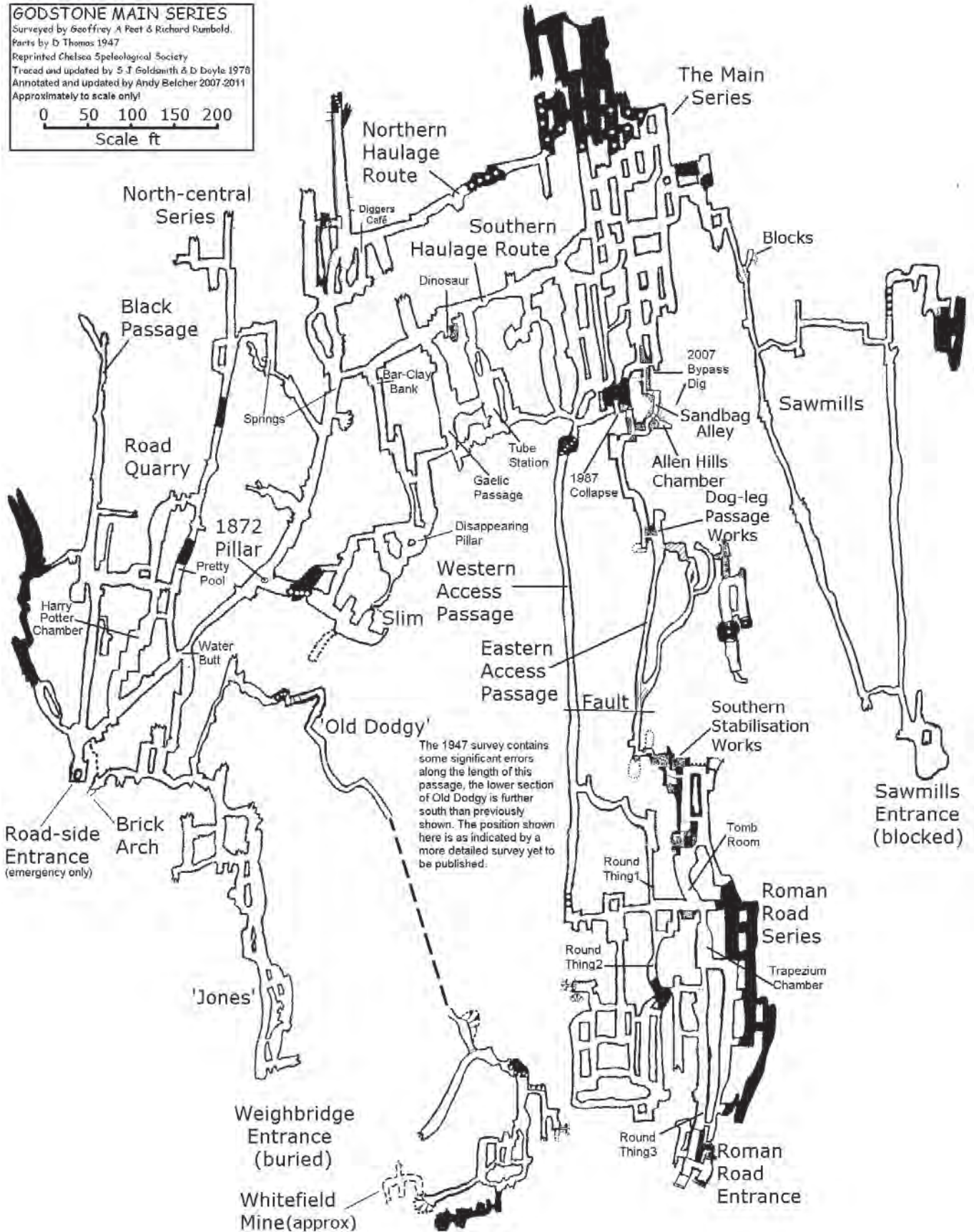
Tim Wellburn

Three golden rules: (1) don't wander off; (2) if you get lost, stay where you are (see rule 1!); and (3) don't touch anything except the floor! Andy Belcher, of the Wealden Cave and Mine Society (WCMS), who led the

recent SubBrit visit through the Godstone labyrinth, was particularly emphatic about the last of these. Finding lost souls is routine to WCMS; having the roof brought down is another matter. We were soon to see considerable evidence

GODSTONE MAIN SERIES
 Surveyed by Geoffrey A Peet & Richard Rumbold.
 Parts by D Thomas 1947
 Reprinted Chelsea Speleological Society
 Traced and updated by S.J Goldsmith & D Boyle 1978
 Annotated and updated by Andy Belcher 2007-2011
 Approximately to scale only!

Scale ft





A number of features are seen in this main haulage route running south-west (behind the photographer) to the road-side entrance. The ruts in the floor show where the plateway has been removed. Two types of roof supports are seen; wooden pit props were probably installed by mushroom growers in the early 20th century; earlier stone roof supports utilised quarry waste. The grooves on the wall on the left are not rope grooves but were probably made by harness of the middle of three horses pulling wagons. Photo Nick Catford

of natural forces working to do just that – without further human encouragement.

Paul Sowen introduced the visit, having also kindly provided us with briefing notes [1] on the East Surrey/ Godstone mines and quarries (including the above strictures). This visit report draws directly on these, and on the equally informed commentary given by Andy as we walked round, and on his published articles *Godstone Observations* [2]. Any errors are all mine.

A little history

The area between Dorking and Godstone, containing outcrops of the Upper and Lower Greensand beds, is an area of intensive quarrying and mining. In east Surrey, a ‘quarry’ can be either an open-cast or underground source of squared building stone. A ‘mine’, traditionally, implies mineral extraction in broken lumps. For simplicity, I have used the term ‘quarry’ although, often, a more correct reference would be to ‘quarry and/or mine’. The Romans extracted firestone blocks in the first century AD, although quarrying on any significant scale probably dates from around 1400, reaching a peak in the Victorian era. The Upper Greensand provided building stone from early times, although this acquired a poor reputation – if exposed to alternate wet and dry conditions it disintegrates!

Accordingly, proximity to the London market was likely to have been the main selling point – although being light, the stone does have some specialised uses including as ‘hearting’ for cores of bridges and foundations. Higher-quality stone depended upon expert selection by the quarrymen.

The quarries’ big market came with the nineteenth-century growth of northern industrial towns, where supplies of Surrey hearthstone satisfied the Victorian urge to whiten hearths, doorsteps and the like. As an aside, Paul Sowen commented that he had not been impressed with the effect when he had ‘tried it at home’, although it did not result in a trail of footprints throughout the house, as did a similar application of chalk.... Refractory stone was also extracted from Godstone and other locations, probably in the eighteenth and nineteenth centuries. However, this could have been used only in relatively low temperature applications.

The Godstone Hill workings are both extensive and archaeologically complex – see the plan, based on the 1947 survey by Rumbolt and Thomas, updated by Andy. Parts are flooded and/or collapsed. In 1936, deep flooding caused the collapse of all the main galleries running north, and there have been further large roof falls over the last

fifty years, with more expected as a result of recent wet weather and associated flooding.

Quarrying was by 'pillar and stall' working, following the 4-5 degree northerly dip of the strata, with stone output maximised by lateral 'eyes' being driven through the pillars. The extraction ratio was approximately 75 percent, but much less than this was brought out, leaving the quarry full of waste, which fills many worked-out stalls, usually contained behind dry stone walls.

Without quarry records it is hard to date the Godstone workings, but the earliest parts are probably C18 and most of what is still accessible is likely to be post-1830. The Victorians quarried on a much more industrial scale than their predecessors, driving larger galleries through the structure of the old quarry, extracting both large building blocks and small hearthstone blocks, including extensively reworking the old quarry waste.



The group underground. Photo Richard West

There is evidence for this both in the lack of larger pieces of stone found in the spoil, and also in the distribution of small artefacts. For example, parts of a single clay pipe were found in three different locations, including one separated by two internal walls. The removal of the waste (which served as an additional roof support) also exposed pillar faces which then dried out slightly, causing large slabs to spall away, creating general instability.

The quarry displays three successive generations of haulage: by wagon ("rutway"), plate way and narrow-gauge tramway, although the last may have been installed by the mushroom growers who brought in large quantities of Gault Clay to level out the floor. The plate way is of exceptional interest, with extant sections comprising a number of different types of plate, but including some marked "CM&G", proving their Croydon, Merstham and Godstone Iron Railway provenance. Peter Burgess's fascinating account of plate rails in Godstone and other Surrey firestone quarries can be found in *Subterranea* 20 [3].

It appears that there was reasonable continuity between the end of quarrying and the early twentieth-century use of the quarry for mushroom farming. The latter was far from passive usage: there is evidence that the quarry was re-engineered for mushrooms, with new routes excavated, waste relocated and old routes backfilled. Airflow was modified by the erection of brattices (wooden partitions)



The Group study plate way points. This junction was cleared of mud and cleaned by members of WCMS in recent years.

Photo Nigel Wellburn

and, in one place, by the excavation of a short ventilation tunnel. Water pipes were also installed, and walls and floors lime-washed, to create a sterile environment. Curiously, there is evidence that (at least some of) the mushroom farmers came from France and/or Belgium.

Following in the footsteps of the quarrymen and mushroom farmers

We entered the quarry through WCMS's secure hatch at Roman Road, located at the southern end of the



Our guides Andy Belcher (WCMS) and Paul Sowan (Sub Brit) at the Roman Road entrance. Photo Nigel Wellburn



hearthstone galleries. In fact, this never was a quarry entrance, but simply the site of a ventilation chimney built by the mushroom growers. Once inside, we soon came to some surprisingly wide stalls, interspersed with narrow passages where the remaining space had been largely filled with quarry waste retained by dry stone walling. We clambered up past a collapse, dug out and shored up by WCMS, into a small chamber decorated with ample recent carbide graffiti on the roof. However, the main interest here was geological, with the quarry's different mineral strata exposed.

Immediately below the very hard roofstone was a notably soft blue-tinged siltstone which broke into dust between one's fingers – of no use for quarry extraction. The hearthstone, and then the firestone, were to be found some way below this. Interposed in the latter, about a foot off the floor, is a thick chert bed (the 'Ankle Bed Chert'), of no commercial value, but utilised within the quarry for walling blocks.

Some way north from the chamber we came to the fault line which runs through the quarry. The strata are displaced by about three feet (1m) and beyond this point the beds are closer together, so the quarry roof is lower. Carrying on further into the quarry, we reached the site of a major 1987 collapse. As it is inaccessible from above and impossible to dig from underneath, WCMS's only option was to bypass it, which they did in 2007.

Andy estimated that some five hundred sandbags had been used in building the modern equivalent of a dry stone wall. Overfilled to 60 – 70 lb (+/- 30 kilos) and hammered tight, these formed a very effective bulwark. Andy remarked that dry stone walling, especially that built to retain underground quarry waste, required specialist skills – which the WCMS dig team had had to acquire empirically.



This pillar has been in a state of collapse for 40 years but visitors still always give it a wide berth. Photo Nick Catford

We soon came to more clear evidence of the instability of parts of the quarry, noting flaking pillars, ominous cracks in the roof and numerous collapses in stalls and eyes to either side of our immediate route. We trod cautiously around areas taped off – for all-too-obvious reasons. One overly-ambitious chamber seemed to be supported only by

a central 'disappearing pillar': we did not dwell there but picked our way gingerly and quietly around the rock debris spilling across the floor, trying not to let our imaginations run ahead of us.

We now also saw evidence of the extent and depth of the 1936 flood in an obvious 'tidemark' some five feet (1.5m) up the wall of an adjacent gallery. Providing a horizontal reference, this also highlighted the distinct gradient of the quarry, following the northwards dip of the strata.

We also paused to examine some lateral grooves worn in the passage wall on the inner radius of a bend. Assumptions that these were evidence of rope haulage were disproved by closer study. Rather, they are likely to have been worn by the harness of the middle of three horses in a 25-foot-long tandem assemblage, hauling stone on the quarry plate way – of which more anon.

Having studiously avoided touching anything, it was a relief to find that the ventilation passage ('Slim') we had to negotiate was cut through sound rock. Only about three feet high by less than two feet wide (approximately 0.9m x 0.5m), it was a bit of a squeeze for some. Those familiar with Pooh Bear's visit to Rabbit's burrow will get the general picture.

Historic graffiti

Beyond this, Andy pointed out a date of 1748: the oldest (yet) found in the quarry. Other dated inscriptions include "RH+ AH 1843" (carved by Messrs Hills), on one of the working faces where the Victorians punched their way through the old workings. One Charles Jupp, born in 1900, and whose whole family worked in the quarry, has apparently engraved his name and age in many places. We saw an interesting example: "C. JUPP", carved in a stone set at ground level in a retaining wall.



The remains of linear mushroom beds are seen here. The wooden props also date from this period. Photo Nick Catford

Assuming Mr Jupp did not lie on his belly to effect this piece of graffiti, one may deduce that the stone was moved to build the wall, probably shortly before the First World War, providing evidence of the continuity between the quarrymen and the mushroom growers – and of the re-engineering of the quarry for the latter activity.

We saw the remains of several mushroom beds in stalls which had been cleared and prepared for the purpose. One area in particular was quite well preserved (with WCMS's nurturing). The raised three-foot-wide linear manure beds somewhat resemble medieval strip-and-furrow cultivation. The remains of the sterilising lime wash was clear to see on the walls. The growers also used some of the old spoil, which they sieved to 'case' (dust) the manure beds. The used manure was not dumped in the quarry but was removed, presumably being spread on adjacent fields, although there is no documentary evidence for this.

We now came upon two adjacent access points of different vintages: the silt-filled 'Brick Arch', an original entrance now buried about 30 feet (9m) under the central reservation of the A22 and, a little further on, beyond a rusting iron grille, the 'Roadside' entrance shaft which provides an emergency exit.



The brick arch is an original entrance, buried during the construction of the A22. Photo Nick Catford

In the sections of the quarry nearer the surface, some water penetrates the calcite strata. In a few places, this has been made use of as a source of water.

Andy showed us a clay-lined 'bowl' carved out of the dry stone wall and spoil, just below the roof. This may have been the water catchment for the "special baling place made in the wall of the quarry" noted by F.A. Holloway in recording his mother's recollection of fetching buckets of drinking water from a spring in the quarry in the 1880s.

Elsewhere, the mushroom growers had drilled small boreholes in the roof to channel water into collection tanks. One of these boreholes had developed an attractively veined and scalloped calcite surround. There were also intricate gour formations on the wall and floor. Numerous lengths of water pipe were to be seen: also relics of the mushroom farming era.

However, the most significant artefact in the quarry is undoubtedly the plate way, laid to approximately 3-foot (0.9m) gauge. This gauge reflected that of the existing wagon rutways: substantially less than that of the CM&GIR, which had been the (original) source of at least some of the rail. Interestingly, the plates were laid with the

vertical flange outermost, contrary to normal practice on surface plate ways.

Andy believes that this was to minimize the trip hazard for the horses. Some of these plate ways disappeared under walled-up quarry waste. We also saw later tramway, laid to a narrower gauge, and memorably, in one place, set within the gauge of the older plate way, which itself was laid in the grooves of the prior rutway: archaeological evidence of successive generations of haulage.



Mushroom growers' tramway and spoil walls. Photo Nick Catford
The real glory, however, is at the extremity of the (currently) accessible workings, where painstaking – and no doubt back-breaking – work by WCMS has (literally) uncovered a number of plate way junctions, some still preserving the timber work to which the plates were secured. These excavations reveal how it had been – rather crudely – engineered and worked. Andy remarked that in one place, there was a short spur where the plate way was effectively a monorail: the other 'rail' had simply been a length of oak, expediently set in a rut.

Our sincere thanks are due to WCMS and in particular to Andy Belcher who really brought the Godstone quarry to life for us with his enthusiasm and extensive knowledge. He and his colleagues from WCMS continue to do considerable work in studying and exploring the quarry, for instance in digging some of the main galleries which collapsed following the 1936 flooding. They expect further collapses, and cannot prevent these, but are constructing a by-pass to provide alternative access: a very understandable precaution!

Footnotes and references

- [1] Paul W Sowan: *Godstone Hill Quarries, Mines and Mushroom Farm Visit, Saturday 28 June 2014 & East Surrey Mining District* (Unpublished)
- [2] Andy Belcher: *Godstone Observations – Cave & Quarry No.6, 2011 Godstone Observations – Introduction*, which contains links to topic-specific sections, can be found in the WCMS Members' Archive at: www.wcms.org.uk/cgi-bin/wcmsarchive.pl?archid=godstoneobs_1intro_cq6
- [3] Burgess, Peter: *Plate Rails in the Surrey Firestone Quarries – Subterranea 20*, September 2009.



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Cotswold Outdoor have granted Sub Brit members a 15% discount on their products (excluding sales and special offers). The details are included in a letter on the website at www.subbrit.org.uk/docs/discount-cotswold-outdoor.pdf

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The discount code can be used in any of their 58 stores (there is a barcode on the letter), and for telephone and online orders.

**** Please do not share or abuse the code as this may lead Cotswold to withdraw it which would be a great shame and spoil things for the rest of our members. ****



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